

# TQM Volume-8

## Total Quality Management in Factory Management

*The Arrow Diagram*

2024a Edition

Kouichi (木村 紘一) Kimura



Factory Management Institute

COOPERATING TO REACH EXCELLENCE



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**Kouichi (木村 紘一) Kimura Sensei:** International Consultant of the TPS (Total Productive System), TQM, TPM (Total Productive and Total Preventive Maintenance), Kaizen, and Factory Management. Expert in introducing and fixing these through personal growth and assistance to the management of the change organization.

Kimura *Sensei* worked in **Office and Production-Gemba** for more than 45 years, during which he developed the JIT production system as a supplier for Toyota, Honda, etc. in SUMITOMO Corp. from the position of a young engineer to General Manager passing through internal & external consulting.

At the time of publication and beyond the age of 80, he continued working on disseminating original Japanese methods and more knowledge, even the ones learned from the pioneers. He has been an international consultant for the last 30 years in more than 11 countries, training clients, as a lecturer and writer. Even now, experimenting, researching innovative methods, and growing in the field of Production Management and Corporate structuration.



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Autor/Author:

Sensei Koichi Kimura – JAPÓN/JAPAN © 2024

<https://jp.linkedin.com/in/kouichi-kimura-2ba37152/en>



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Notes: Going and coming back to the main theme.



The third level of the Issue provides more clearness to the structure of the text to the more relevant.



Lower levels of the Issue, commonly 6<sup>th</sup> or 7<sup>th</sup>, and, pointing out necessary explanations about pictures or graphs.

## UPDATING TABLE:

Date, Version-Previous & V-Next	Chapter (I..XX...)	Chapter Point.- sub-point : (Updating)

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# I. Prologue

Several times, I have written about the importance of diversity. One purpose of diversity is the expectation of "hetero-molecular reaction." Of course, the main purpose is to look at things from a wider perspective.

By the way, I have felt some concerns recently; after CORONA (COVID-19), I was invited to a company's group discussion. After a long time, I was glad because I could listen to the young people's dialogue. It was indeed a happy thing. But I felt something strange. What is this? What is this feeling? Why do I feel "something strange"? I remembered that I had felt similar discomfort past the date.

Anyway, they were discussing the Environment. They were seriously discussing how their company can contribute to the Environment. And I found why I felt something strange. There's no humanity to their dialogue and the conclusion. It is like AI such as Chat GPT. It has no personality. Each company has its own history, culture, and personality. I couldn't feel these in the dialogue and the conclusion.

## **Disappearing a personality.**

Why? They seemed to lose "individuality". Why? ...The "diversity" is the exertion of "individuality." They have their opinions. But these were not deep exertions of individuality. Therefore, their answer is like an answer from the textbook. Not deep, but flimsy.

What were the causes? ...The form of discussion? It was Brainstorming style and no problem. Chairperson? ...Not a facilitator and a little problem.

Diversity? ...There was no problem. Then what was the cause of my discomfort? ...Of course, the reason was the answer led out. It was so uniform, even though the diversity was considered.

Why were their ideas so uniform? ...Before the meeting, they were requested to study the factory environment. They studied the full use of SMS. This seemingly is the cause of the uniform young generation.

I questioned them, do you read newspapers every day? ...As I assumed, they don't read a Newspaper. According to them, instead of newspapers, they read news through SNS. However, SNS is very convenient. I also use it very much. However, it is necessary to pay attention to the loss of the "diversity of wise."

One day, I clicked a photo of a swimwear lady. After this, similar columns were highlighted. Moreover, on the right-hand side of the screen, AD photos of Bikini Swimwear are highlighted. (fed up)

SNS has such a function. On the other hand, people have the tendency of looking at which he/she wishes. By both, their thinking was lost the "individuality of wise."

Then, not only the young generation but also, we need to think about the "diversity of wise" by reading newspapers, novels, and print.

## **Summary:**

*In this lecture, Kimura Sensei discusses the significance of the Tree Diagram as a key tool in Total Quality Management (TQM) for factory management. He begins by emphasizing the value of diversity in problem-solving and decision-making, noting that a diverse range of perspectives can lead to more innovative and effective solutions.*

*The lecture centers on the practical application of the Tree Diagram within the context of a factory's expansion project, where the team faced challenges in managing the construction schedule and budget. Kimura Sensei guides the team through the process of using the Tree Diagram to break down complex tasks into manageable components, thereby improving their ability to plan and execute the project efficiently.*

*He also introduces the Arrow Diagram, another essential tool in TQM, which complements the Tree Diagram by helping to visualize the sequence of tasks and their dependencies. Through a detailed case study, Kimura Sensei demonstrates how these tools can be integrated with methods like Brainstorming and the KJ Method to enhance creativity and problem-solving in project management.*

*A significant part of the lecture involves the discussion of a Ji-shu Ken meeting, where the concept of self-study groups within a company is applied to foster a deeper understanding and problem-solving capability among team members. During this meeting, the team continues their study of Break-even Point (BEP) analysis, a critical financial tool for understanding the profitability of projects. Kimura Sensei highlights how the Ji-shu Ken approach encourages continuous learning and improvement, empowering employees to take ownership of their development and contribute more effectively to the organization's goals.*

*Throughout the lecture, Kimura Sensei emphasizes the importance of critical thinking, creativity, and the need to avoid cognitive biases in planning and decision-making processes. He underscores the idea that successful management involves not just technical knowledge, but also the ability to think holistically and adaptively in the face of new challenges.*

.

## II. Arrow Diagram (One of New QC 7 Tools)

The arrow diagram is one helpful method. What makes it valuable? Let's consider it.

Next is a story about a company that was my client company. To write this true story, there were too many actors. Then, I wrote this story with just limited actors who were the Company Chairperson (CP), Managing director (MD), Financial and accounting department (FD), General Manager of Engineering (HE), Accounting department Manager (AD), and Engineering department staff (Ef), plural engineers.

**Expansion Review Meeting:**  
**CP:** Chairperson  
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I supported this company for several years in improving factory management. This company had a plan for new plant expansion. At that time, some processes, such as land acquisition, land levelling, and plant layout design, had been completed.

One day, all departmental managers and the above main actors held a grand meeting. A big conflict (?) or commotion happened at the conference.

The Chairperson intervened: —Mr. Head of Engineering, so will the construction period be on time? I cannot confirm whether we can catch up on the construction period using this Gantt chart.

—Sorry for the inconvenience —the Head of Engineering apologized—. Using these Gantt Charts, precisely identifying the relationship between the construction works is impossible.

This project used Gantt Charts. These graphics comprised The Master Gantt Chart and the Gantt Chart of individual work elements, including 17 main works such as Land acquisition and layout, Equipment detail Layout, Installation of the 500-ton press, etc.



Figure 1: Gantt Charts

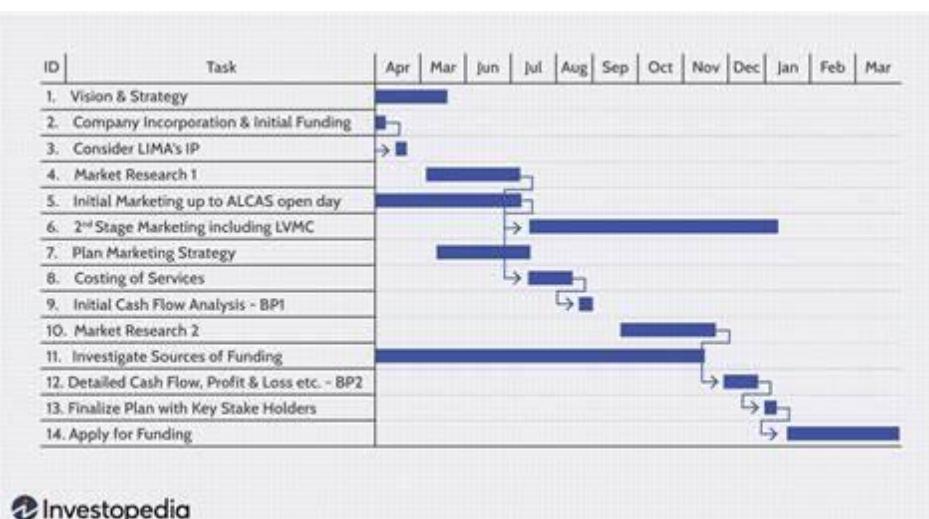


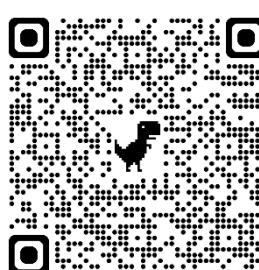
Figure 2: Sabrina Jiang / Investopedia: <https://www.investopedia.com/terms/g/gantt-chart.asp>



Figure 3: HH list

When I was chattering with the Chairman and having coffee, he asked me to attend this grand meeting, even though it wasn't involved in our consulting contract. I participated in this new plant construction conference without prior knowledge or information.

This plant expansion consisted of several major construction works, including Land levelling, a Sewage treatment facility, A baking furnace, and the Installation of production equipment, including the 500-ton press.

Figure 4: LinkedIn article:  
Zero accidents - TPS. Hiyari-Hatto example and  
description.

This grand conference was a regular conference to check progress against the master plan. The master plan consisted of a Construction schedule diagram (Gantt Charts), Budget and usage, Safety (Hiyari-Hatto<sup>1</sup>), and an Expected problem report.

—Anyway—the chairman expressed--, I don't understand the contents of this presentation. And, what is the purpose of this grand meeting?—he finally gently requested to the Head of Engineering. However, he was starting to feel grumpy.

The Head of Engineering, showing a nervous expression, answered —The purpose of this grand meeting is 3 points: One is to report the progress. Another one is the construction period of the following financial period (20xx Alp. 1st) will be delayed. The final purpose is to show the possibility of additional construction expenses.

While flipping through the pages grumpily, the chairman answered: —Mr. FD, did you know the necessity of additional investment? And, as far as I see, that's quite a substantial extra amount.

Yes—the Financial & Accounting Manager affirmed while flipping pages—; I had been informed a few days before, and I suggested the Head of Engineering hold this grand meeting. Also, I suggested a recovery plan for both the construction period and construction costs.

—Anyway—FD continued—, Mr. HE, unfortunately, it is not possible to discuss it with this material. Please, please, please—he insisted—please make the recovery plan for the construction period and the shrinkage of construction costs.

The Head of engineering is hesitating and stammering but pretending to be determined: I admit our capacity to make complete design and planning is short. However, it is the first time to plan and construct a new plant for us. Additionally, we were pushed with a rigorous schedule and costs. Particularly construction costs. It is related to the period of construction. We need to finish the construction up to the end of this financial term and start production from the beginning of the new financial term.

#### **Expansion Review Meeting:**

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<sup>1</sup> Hiyari-Hatto list:

<https://drive.google.com/file/d/1m7hrUZew9odQTaZxD2BgjXMe8dvYRbl/view?usp=sharing>

**Total Preventive System, Hiyari-Hatto example:** <https://www.linkedin.com/pulse/total-preventive-safety-eduardo-l-garcia/?trackingId=sbZiAHpwQXyCXjvvIEDDYQ%3D%3D>

The discussion between the Financial Director and the Head of Engineering continued for some minutes; after that, the Chairman broke the debate: —Anyway, which part should be delayed?

While flipping the slides and searching for the relevant information, some of the engineering staff intervened: —This part included the schedule of 500-ton press installation and precision machinery. In fact, a specific point has come to light: the distance between press and precision machines. When Sensei visited our plants, we guided his plant tour as usual. And, I guided him to the new plant site and explained the layout plan. At this time, Sensei pointed out the concern about the distance between Precision Machines and the 500-ton Press.

—Sensei —the chairman caught my attention—; once again, please let me know your suggestion. What is your concern?

—Well, I spoke to him about an episode of a Japanese company with large press and precision machines.



### *The fact of this history*

*Unexplained defects have plagued this factory for many years. Precision machines produced these products. Several times, maintenance engineers checked and took action to prevent defects. However, no countermeasures had specific effects.*

*One day, when the engineer checked the machine's condition, one operator tweeted: —I don't always feel it, but there seems to be a slight vibration.*

*Engineer: —Well, even precision machines are still machines, so it's natural for there to be some slight vibrations.*

*—But is this vibration really coming from this machine? —the operator asked— I'm not sure, but I think it might be something different.*

*This factory also has large press machines, but it had these in the distant plant. Therefore, it is impossible to think about the influence of the distant presses. But this engineer and the operator had a flash and shouted simultaneously, "Shinkansen (bullet train). "*

*Indeed, a railway line of bullet trains is a few hundred meters away. Thus, they investigated the correlation between the faint vibration & the pass of a bullet train and the vibration & defects. Then, they could confirm the true character of defects occurring.*

The engineering staff mentioned then: —I began to worry when I listened to his story. The worries were the distance between the 500-ton press machine and the precision machines and the prevention countermeasures of anti-vibration in both machines. The area concerned is not just the distance but also the vibration strength.

—I'm very sorry —the engineering staff continued—, we mistook the design of the foundation. It is necessary to re-design the foundation, including the depth of land and the steel frame assembly.

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**Expansion Review Meeting:****CP: Chairperson****MD: Senior Managing Director****FD: Financial & Accounting Dtr.****HE: Head of Engineering****AD: Accounting Director****Ef: Engineering Department staff**

Everyone was murmuring, and suddenly the Financial Director showed his concerns: —I'm shocked. I'm an amateur about the subject, but how about the anti-vibration device? I believe you have already ordered the devices. Are they possible to use?

—Some design changes are necessary for the anti-vibration device.

Crossing his arms in deep thought, the chairman expressed his concerns, trying to summarize: —In short, In short, the cause of the construction period delay and additional investment related to this 500-ton press re-planning, isn't it? Are there any others? —he asked.

—Yes —the Head of Engineering detailed—, the base cause is this press mounting. However, in parallel, it is necessary to reconsider the total layout because of the distance between the press and precision machines. It is required, even though it is implemented, the re-planned foundation and anti-vibration devices.

—Are there other concerns? —the chairman asked again.

—Our team is re-reviewing the total plan, which will soon be finished. We will also identify the construction period and the total investment. And, I beg you to wait several days to answer.

—Hey, Sensei —the chairman asked me—. Something terrible has happened. Can you give me some advice on what to do?

I was caught off guard. Because it was an unexpected invitation to this project's grand meeting, I had no background knowledge about this project or plant construction itself.

—Well, what are your concerns? —I asked him—Probably, the area of your concern is the delay in the construction delivery schedule and the additional construction cost as well, right?

To buy time for thinking, I tried to deliberately confirm things that we already knew.

—Hmm, before my suggestion, I have a question for the Head of engineering. Do you have other concerns about a lack of construction items in your Gantt Charts?

The Head of Engineering detailed: —It doesn't seem easy to say. Yes, we have this concern. Therefore, we are revising the construction schedule items in the Gantt Charts.

—I see —I was gaining this time, indeed—. You will probably have concerns even after finishing the review work. Unfortunately, you made mistakes when making up the plan. For such a plan, the Gantt Chart is not helpful for the following 3 things: The first one is that it is difficult to understand the relation between work and work. If just a one-page chart, it is possible to identify the relation of work to work. But, if there are many complicated charts, it is impossible to identify each construction sequence's relation.

—Another is that poor inventiveness or imagination —I clarified—. One of the causes of the inventiveness difficulty was you used a Gantt Chart rather than an Arrow Diagram.

—The last step is not to do a Process FMEA for each work item. This is no necessary to do for all work items, but you need to do, if you have a concern.

—No inventiveness (Imagination) —the Head of Engineering expressed discomfort on his face—. Sensei, we made one-day camp to extract the necessary construction work items by my engineering staff. Of course, we considered the work item sequences.

...

—I understand your effort, particularly, it was good you made one day camp. However, I don't recommend a camp-type concentration work. The capacity of humans regarding brain thinking concentration is 90 minutes. Moreover, to keep concentration, it is necessary to have a 15-minute break. I don't know your camp condition. But generally, using a meeting is not practical because imagination & thinking capacity are destroyed by the atmosphere. If you want imagination & thinking you need to change the atmosphere of the meeting room.

In the middle of my speech, the chairperson said: —As the result of that, there is no meaning if we have such problems, even though you made good activity —he told the Head of Engineering.

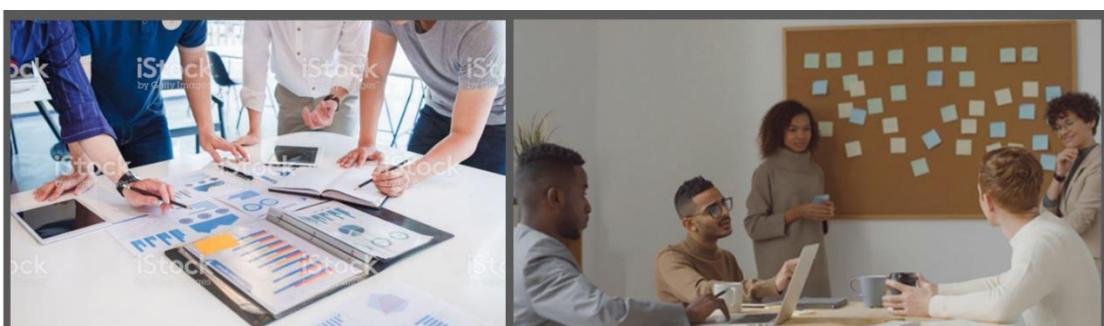
Maybe he commented something about that extent instead of me, but he continued: —Sensei, what can we do? Can you help us with these two difficulties?

—Hmm. OK. Let's reconsider the schedule and construction work items. So, I have three suggestions for this work. The first one is to use an Arrow Diagram. My Arrow Diagram is different from your image. The second one is to use KJ Methods for better inventiveness. And the last one is to do Process FMEA, in combining Arrow Diagram.

—Sensei, why KJ? —one engineering staff asked—. We tried to dig necessary work items by Brainstorming. Unfortunately, we recognize that we dig not deep enough. We believe our way is correct and we like the method of Brainstorming. Quite often, we do it for discussion. Therefore, we wish to implement Brainstorming discussion rather than a new method (KJ). Can we?

—You did some Brainstorming in camp, didn't you? It was indeed perfect. If you like Brainstorming, let's do it to dig necessary work items. So, please let me confirm to confirm your Brainstorming and my image.

—Everyone, there seems to be a trend in the Brainstorming method —I began, showing some pictures like the next ones, but it is just my opinion. Actually, I didn't use the following pictures.



The second trend was as the right picture: It was to begin the "Spatial layout" →



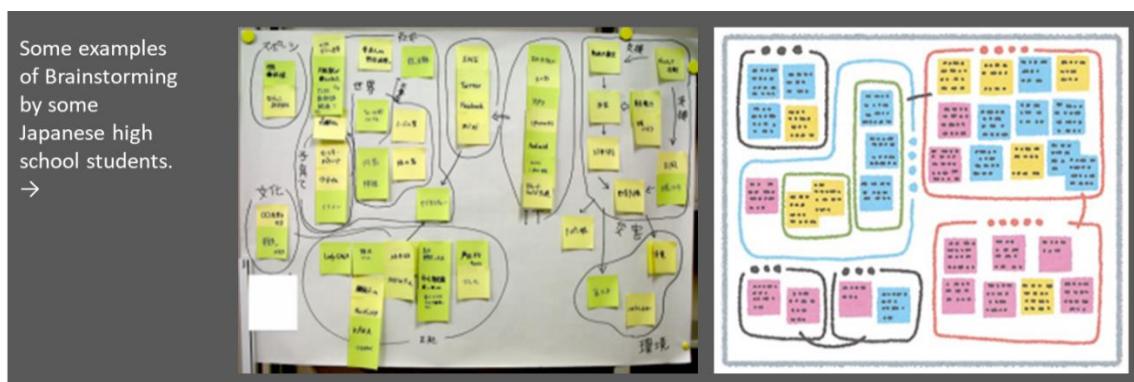
What is the merit of using a spatial layout with cards? ...The initial Brainstorming and Second trend. And, what are the differences in the method and the effects? ... First, note on paper. Second, use cards. Thirdly is (I say) flat thinking. Finally, it is Three-dimensional thinking.

As you understand, Three-dimensional thinking is better for inventiveness. And now, another trend has happened: It was pretty natural, and it was grouping ideas.

But Grouping? How? ...There are 3 ways:

- One is the same and similar ideas grouping.
- One is the ideas having a relation.
- One is "Somehow inspirational."

One way of brainstorming is to create ideas. It involves not only thinking with one's brain but also inducing ideas from other cards.



—Interesting Mr. Kimura —the Chairman recognized—. It is very much interesting. Mr. Head of Engineering. Your staff usually uses brainstorming, but which type of brainstorming are you using?

One of the engineering staff members answered him: —Our style is probably the same as initial brainstorming, but not on paper, and we will first record all opinions on the whiteboard. Secondly, we grouped and recorded on paper.

—Everyone —I requested their attention—; I asked for the condition of Brainstorming 3 points for this project. Once again, the first one uses an Arrow Diagram. The second one is to use KJ Methods for better inventiveness. And the third one is to do Process FMEA, combining Arrow Diagram.

—Now, I continued—, I don't push to use KJ, and you can use Brainstorming, but please use cards. Moreover, may I ask you to add another recommendation? —I continued without waiting for any answer—. It is the Brainstorming member's diversity. Your members were composed of just engineers and factory people. As concretely, please add office Gemba people such as General affairs, Human resources, and Accounting departments.

The engineering staff mentioned showing an expression of perplexity, surprise and ignorance: —With all due respect, Sensei said they have no understanding of the realities of Gemba.

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I instead omit this dialogue. Thus, after this dialogue, the engineer's group left and continued this discussion only with the Chairman, the Financial Manager, The Head of Engineering and me.

—I also think additional members such as office staff have no meaning, as the Head of Engineering mentioned. Anyway, it is inefficient to increase members. I also want to have a brainstorming meeting with current members.

—They have no Gemba experience or knowledge of equipment —the Head of Engineering objected—. I cannot understand what you are thinking, Sensei. It is not a game, and we are very serious.

At that moment, I thought, where does his stubbornness come from? Anyway, he was stubborn and tried to push through his idea. And I was fed up with his attitude.

—Ha, ha, ha. Yes, they are. But "no understanding of the realities on Gemba" is a better thing for Brainstorming —I observed.

However, he cut off my word: —They do not know about the production processes and equipment and the construction works. Is there a meaning in adding such people to this project?

I was feeling lousy, and even though I continued: —Knowledge? Mr. Head of Engineering, please understand what knowledge you have and what knowledge you don't have. What knowledge do they have, and what does not?

—It's a harsh way to say it, but you were also ignorant about the construction work of the heavy-tonnage press installation.

—Hey you! —I pointed out—. A piece of knowledge depends on memory: the brain stores learned information as memories, and those memories become knowledge. You may know many things about Gemba and its equipment. However, It's not that big a deal. It seems you have an iPhone, which was just started to sell, have you? How much of the memory capacity of it?

—About 16GB —he answered.

—Ha, ha, ha! Mr. Head of Engineering. A human has a 1GB memory capacity. And your brain is only 1/16 of iPhone capacity. Another words, your memory is only 1GB. Do you think it is sufficient to make a plan?

—Inspiration, imagination, and creativity are essential for making plans or new ideas. Even though new ideas are not required, oversights of necessary processes are fatal. For your team, this is their first experience. Therefore, it could have been a world of inspiration, imagination, and creativity. Probably based on such inspiration, they investigated the necessary steps or technologies.

—Moreover, this time, such a large construction program is the first experience for you, do you? ...When looking at this project, members are composed of engineers, quality engineers and Gemba supervisor, a total of 7 people. They have 1GB of memory each. But the problem is that they have the same memory in their 1GB memory. In another word, the group has the same homogeny. Why I recommend

**Expansion Review Meeting:****CP: Chairperson****MD: Senior Managing Director****FD: Financial & Accounting Dtr.****HE: Head of Engineering****AD: Accounting Director**

"Diversity". It is necessary to seek the possibility of  $1\text{GB} \times 7 = 7\text{GB}$ . Unfortunately, probably your group could have exerted their capacity of  $1\text{GB} \times 7 = 2\text{GB}$ .

When speaking, I was regretful. I also have no experience or knowledge. But I cannot return because of so strong words against him.



### *The Human Memory capacity*



*When I visited this company, a person had the first iPhone with 16GB memory capacity. On the other hand, according to Prof Steven Sloman's recent thesis, the human memory capacity is only 1GB. The newest iPhone (2024) has a 128GB memory capacity. In short, humans have the memory capacity of only 1/128 of iPhones.*

*Steven Sloman is a cognitive scientist and a professor at Brown University (specializing in cognitive, language, and psychological studies). He is known for works such as "The Knowledge Illusion: Why We Never Think Alone," where he delves into why people often overestimate what they know and explores the nature of knowledge by itself.*

However, the problems of this time are not only the lack of a particular item but also "awareness with creative thinking (realization)."

—Mr. Head of Engineering, you have 3 insufficiencies. One is insufficiency of knowledge itself or bias of expertise. One is insufficient awareness by creative thinking. Another is your recognition biases: Confirmation Bias, Anchoring Effect, Conservatism Bias, Status Quo Bias (Hindsight Bias) and Overconfidence Bias. It would help if you recognized that you are very stubborn.

And even he has not Hindsight Bias, he was suffering all of the rest ones.



### *Cognitive bias and Stubbornness.*

**Cognitive Bias:** Somewhere, I wrote about cognitive bias. But one again; Stubbornness or rigid thinking can come from a type of Cognitive bias. Here are some related Cognitive biases:

**Confirmation Bias:** The tendency to prioritize information that supports one's beliefs or hypotheses and ignore information that contradicts them. This makes it easier for rigid people to maintain their beliefs without changing them.

**Anchoring Effect:** The tendency for the first information one receives to have a strong influence and bias subsequent decision-making. This makes it easier to stick to one's initial beliefs and opinions.

**Conservatism Bias:** The tendency to be conservative in revising existing beliefs based on new information. Even when new evidence is presented, one may not significantly change one's beliefs.

**Status Quo Bias:** The tendency to maintain the current situation. To avoid change, one sticks to existing beliefs and behaviours.

**Hindsight Bias:** The tendency to believe that an event was predictable after it has occurred. This provides a justification for continuing to believe that one's past decisions and beliefs were correct.



### The composition of awareness by creative thinking. (From TQM-3)

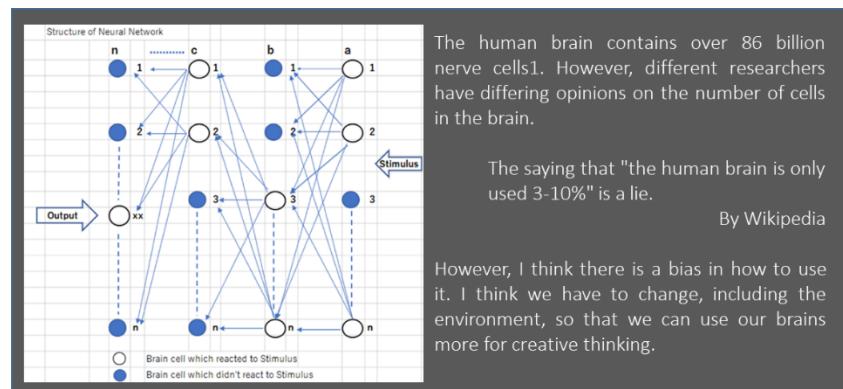


Figure 6: TQM-3 Hardware, Software & Diagnose + Cost Reduction 6

Information and experiences are collected and stored in the brain. Ideas are not generated directly at this stage, but knowledge and experiences are enriched.

- The brain unconsciously processes and associates the information it collects, often without any conscious effort.
- When we are faced with a problem or challenge, our brains combine existing information in new ways and have sudden insights.

To reconcile the tense situation, the Financial Director intervened: —Mr. Head of Engineering, you also agree to review the construction program, right? And, it is necessary to make a recovery plan in investment increase and shorten the construction period, right?

—Yes, it is. But... —the Accounting Director broke off the conversation.

—Please listen —The AD said—, Do you believe you can do it with the current same members? ...I'm sorry, but my Financial department staff also attend to the budgeting and review of the investment budget. I also approved this budget....

—At this moment, the important thing is to confirm the volume of additional expenses and the construction period as soon as possible. If there was a mistake in the planning method chosen, it is necessary to reconstruct it —AD continued..

—If there is a concern about members' capacity, it is also a good idea to ask Sensei for help. Restarting as soon as possible is necessary, no, no, in a hurry.

The Head of Engineering tried to speak up something, but the Accounting Manager interrupted him again: —Sensei, what do you think?

—Mr. Head of Engineering, I'm concerned about your stubbornness —but before he spoke up, I continued—. No, no, no, I'm not criticizing you. It is pretty natural to have such cognitive bias. Everybody has such a bias, and it is more or less intense. But the important thing is you can or cannot control it by recognizing it.

—You probably lack awareness through creative thinking. Awareness and creative thinking have different mechanisms, but they are related deeply. This point is also natural to people —I said, even later, I thought I'd told some pretty awful things, which made me regret it again.

—You were probably Brainstorming to gain "awareness (realization)" and gather the knowledge. It was a reasonable act to implement Brainstorming. And as you know, the Brainstorming method has 4 rules:

1. Don't criticize or reject others
2. Welcome free ideas
3. Prioritize quantity over quality
4. Combine and develop ideas

—I don't know who the facilitator was. However, this facilitator probably couldn't lead this brainstorming properly. As a result, the necessary items were missing.

I spoke about his stubbornness and cognitive bias because, honestly, I had two concerns about my capacity. First, I had no experience leading such a massive project about new plant construction. Another main concern is the cognitive bias of current project members. They made up the action plan and the plant construction schedule. They extracted the necessary items and performed the construction procedure. A human has cognitive bias. Therefore, they cannot restart from zero base.

So, how can I help? ...I was thinking about this condition and solution during their dialogue. Then, I used "hetero-molecular reaction" (effect) instead of "diversity."

But is such expression of Heteromolecular reaction (effect) correct? ...I think there may be no such physical, chemical or scientific word, but it may be used. In the fields of chemistry and biology, the concepts of "heterogeneity" (different molecules) and "effect" (action or influence) exist.

A heterogeneous reaction is a chemical reaction in which different types of molecules react to produce a new compound. These reactions typically involve different elements or compounds so that they can make various products.

These terms might be used to examine the effect of different molecules in a chemical reaction or the effects of various molecules in drug interaction studies.

Anyway, I believe such hetero-molecular reactions or effects from the diversity of re-projects are necessary.

**Expansion Review Meeting:****CP: Chairperson****MD: Senior Managing Director****FD: Financial & Accounting Dtr.****HE: Head of Engineering****AD: Accounting Director**

—Please, Mr. CP and Mr. HE CP and Ge —I called their attention—. There is definitely no success in continuing this brainstorming by just current members. The theme of re-planning is about two issues. Are there any? ... One is to recover the construction period as scheduled. The other one is to recover the construction investments as planned.

—Both: CP and HE, please listen —I requested them—. Now you have other concerns, don't you? ...Your concerns are about not having your self-confidence about other oversights. There is no reason to be possible to have self-confidence —and then looking to the HE and FD, I said them: —Mr. HE, can you say there is no other extensive schedule and investment amount change? And, Mr. FD, how much is the prospect of an additional investment amount?

**Expansion Review Meeting:**  
**CP: Chairperson**  
**MD: Senior Managing Director**  
**FD: Financial & Accounting Dtr.**  
**HE: Head of Engineering**  
**AD: Accounting Director**

The Financial Director answered me just before: —Now I cannot understand why the initial investment amount was so small. The estimated amount of individual construction was probably very low. And if I re-estimate individuals and new items, ..., I cannot prospect.

In a short groan, the Chairman expressed his concerns and said: Anyway, Mr. Head of Engineering, please make up the re-planning as soon as possible. No, in a hurry, but accurately. It is a grave issue. It's a matter so profound that it could cost me my head. Sensei, please help us —The

—Mmmh, —another groan from myself, just because I couldn't say them: leave it to me, but I expressed it barely—. Ok, let us restart this project by adding new members.

Shortly after, new project members were announced, and their first meetings were held. The latest three members were Hr (Human Resources staff), Ac (Accounting department staff), and Ld (Legal department staff). The Ef (Engineering staff) also returned to the new meeting.

## 1<sup>st</sup> Meeting

After the self-introduction, the Legal Department staff intervened: —Sensei, I have no experience visiting production Gemba and touching equipment. More than anything, I hate the smell of factory oil.

In my heart, I felt that this was a troublesome selection! But I tried to release the tension: —Ha, ha. May I have questions, Mr. Ld? —without waiting for any approval, I continued—. You have been working for 12 years in your current position, right? However, you have no experience in production Gemba, yes?

—No, sir, I have visited 3 times during these 12 years. One is the time when I joined this company. One is a plant tour with our customer. Another was ... umm —he hesitated.

—Hahaha! —laughed the Hr staff—. You are telling a lie. You have visited **Production-Gemba** many times. Sensei, his partner, works as a production supervisor at Gemba.

—Umm —groaned the Legal department staff. Anyway, I hate Production-Gemba! Moreover, I know nothing about production and equipment. I heard about this serious problem. If there is a necessity for legal problem-solving, it may be possible to support it. However, the problems or targets are the construction period and review of total investment. No matter how you look at it, I have no role to play.

**Expansion Review 1<sup>st</sup> Meeting:**  
**Hr: HR department staff**  
**Ac: Accounting department staff**  
**Ld: Legal department staff**  
**Ef: Engineering staff**

—I see. That's how you think —I disagree—. Well, everyone. Actually, there is a more severe issue. This concern is that there may be a lack of necessary work items.

—Missing necessary work items? —asked the accounting staff—. So, umm, it influences the total investment planned.

I pointed out that nobody can have confidence regarding additional investment increases, and the Ld broke up my speech: —We understand the situation. Nevertheless, I cannot imagine how we can come up with a way to support this project — and he continued...

—Moreover, Many Gantt Charts surround us. The Main Gantt chart may be the master schedule and shows individual work units, a total of 17 units. Those work units show the individual necessary details of the work items. It is indeed detailed. I cannot imagine that there may still be insufficiencies.

The atmosphere was heavy and unpleasant when the accounting staff intervened: —You have found out and known what the insufficiencies were, haven't you? Please let us know these —told to the Head of Engineering.

—Because if you had known the insufficiencies, the construction processes would have progressed more. However, we stopped and decided to re-plan. What did you find? —asked the head of engineering to his staff.

The engineering staff explained that the 500-ton press installation caused the problem: —It was our first experience with such an enormous ton's press. Of course, we have the experience of 50-ton presses or smaller presses. But 500-ton press. The installation is entirely different from our other experiences — and he continued...

—The press's vibration and the machine's precision require fundamentally re-planning the layout. This enormous tons press requires a more rigid base with unique mount materials. It was identified that not only cast iron and steel but also composite materials such as carbon fibre-reinforced plastics (CFRP) are required.

—There are other faults, such as estimation insufficiencies. Anyway, the biggest issue is the review of the fundamental layout.

—Sensei, —asked the accounting staff—. After all, we cannot find how we can support this project by our joining. If you have a suggestion, please show us the hint how can we do.

—Hahaha! Anyway, everyone, please relax a little —I beg them—. Do you know Everest Mountain the highest mountain in the world? —everyone nodded. —So, do you know how many routes to climb it?

—We believe there are 2 routes so far —answered the engineering staff.

—Very good you know very well —I pointed out.

**Expansion Review 1<sup>st</sup> Meeting:**

Hr: HR department staff

Ac: Accounting department staff

Ld: Legal department staff

Ef: Engineering staff

—Everyone —the engineering staff begged a slightly exasperated tone. —Sensei. we are serious. Please don't make fun of us.

—No, no, no and sorry. How many climbing routes does Everest have? I never make fun of you. Your answer is 2 routes. Yes?

...However, the answer is "infinity". It is indeed 2, if limiting just routes found or experienced. But why 2? ...We decided to return to the original trailhead and position of consideration.

—My suggestions are 2. The first one is to go back to the original position. What is original? What is the purpose or target of this project? Constructing a new plant is only the means for realizing the original target. The second one is Everest's climbing routes because there is an infinite number of routes.

—By the way, Mister Ld, Ac and HR. What do you think? What are your strengths and weaknesses?

After some discussions, the Legal department staff pointed out: —I understand our weakness. We have no experience or knowledge of production Gemba. But our strength?

—Yes, you have, haven't you? —I asked everyone. —You don't know any engineering issues; of course, you don't know what current engineering problems matter. Therefore, you lack entirely bias. On the other hand, you have the experience of your expert in jobs and your own life experiences. Only you can start from the trailhead in your brain.

—So, I suggest returning to the trailhead but not to the base camp. What is our trailhead? What is the purpose of this new plant construction?

—Yes, yes, yes —the engineering staff showed enthusiasm—. Our company's target for new plant construction is to realize the long-term policy and vision. They targeted the business expansion by new products and receiving order expansion.

—For these, it is necessary to plan not only the engineering matters, including equipment & construction but also subcontract matters, material procurement matters, human resources matters and the investment plan.

—We have finished preparing the sales expansion in design, production methods, production engineering, and sales advertisement. Unfortunately, yes, indeed, we had a problem with the plant construction. It is a severe issue. We lost about 3 months of construction periods.

The accounting staff pointed out some concerns: —So, how can we start supplying this new product series? Delay the start of sales?

—No —the Engineering staff was blunt—. It is not. We decided on the production with a temporal in-house production line and press process outsourcing. We need to re-establish the construction plan in a hurry. 500-ton press. This heavy press machine will be delivered 2 months later. It is not possible to do temporary placement.

—Sensei told us not to go back to base camp but to trailhead. But please, please, please understand we have no time —the Ef pointed out.

—We understood our company's standing position, sensei —the Hr expressed—. Even so, do you suggest going back to the situation of the white paper?

—Yesterday before, I had a dialogue with the president, and I spoke to confirm his wish: "What do you want to do?". He told me, "Anyway, I hope the construction will be completed as soon as

**Expansion Review 1<sup>st</sup> Meeting:**  
Hr: HR department staff  
Ac: Accounting department staff  
Ld: Legal department staff  
Ef: Engineering staff

possible, and I told him, "Your wish is construction. Why do you wish for the construction to be done earlier?"

—I confirmed his will: Establishing production capacity for business expansion, which is planned in long and short strategy and vision. I tell you the conclusion. Our mission is to establish the means of business expansion with this excellent product series. And this plant construction is one of the means —I continued...

—Please go back to the trailhead. Plant construction is essential because not only the heavy tons press but also precise machines also will be arriving. But please go back to trailhead and start this "Mission Impossible".

## 2<sup>nd</sup> meeting, and 3<sup>rd</sup> meeting

—Please accept my stupid question —asked the Legal department staff—. Even so, is this large and heavy press necessary for new product production?

The Ef affirmed: —it is essential.

—So, how much work volume is there for this machine? —asked Ld.

—Mmmh! So far, according to the plan, the work volume is 25% or less. The future plan is still vague. But according to our calculation based on the sales department estimation, the maximum work volume for this press will be about 50%.

—How can we use the surplus capacity? —the accounting staff asked—. We have some small presses in plant 2. These machines cannot replace this giant machine.

—Not at all —the Ef pointed out—. It is impossible to use it for the new products series. Moreover, please understand that this new press will be delivered soon.

—Sorry again for my stupid question, but can this large machine be used as a replacement for small machines? —the accounting staff asked.

—Mmmh... Yes, it can be —the Ef expressed.

—Uhm, may I have a question? —Ac asked—. Actually, there is an application for a budget for small presses renewal. According to the application form, 3 small presses are exchanged for new ones. Are these new type presses or ordinal type?

—Eh? —the Ef was surprised—. Is there such an application by Plant 2? I believe these are ordinal types and replacements because the 3 ordinal machines were already too old.

—The case of ordinal equipment renewal is not a matter of the engineering department; each plant can do it. Of course, there was some discussion between engineering and the plant. But I don't know anything about it.

—Mr. Ef —the Ac asked—. You answered the question, Mr. Ld, that a 500-ton press could be the replacement machine for a small press

**Expansion Review 2<sup>nd</sup> & 3<sup>rd</sup> Meeting:**  
Hr: HR department staff  
Ac: Accounting department staff  
Ld: Legal department staff  
Ef: Engineering staff

with a surplus capacity of more than 50% to 75%. So, how do you think, isn't it possible to cancel the order of the 3 small press machines? //and he continued asking the Engineering staff.

—And... is it possible to use the allowance of a 500-ton press instead of these 3 presses, which will be abandoned? —this question created a commotion in the group.

—Great! —the Ef congratulated the group—. Everyone, it is a great suggestion! Fortunately, these ordinal-type machines are not in the purchase order, perhaps. I confirm it.

## After this 3<sup>rd</sup> Meeting.

This project invited the Sales and Production planning departments to discuss the possibility of utilizing a 500-ton press from the engineering, designing, workload, and sales prospects' points of view. As a result, 3 machine purchase orders couldn't be cancelled, but 2 were cancelled. In my heart, gradually, the effect of diversity is appearing.

By the way, the engineering staff commented that we had another problem: The location of this 500-ton press —I thought it might be possible to re-consider the area —and he asked—, Why we planned the current location. —he answered himself—: There were several reasons. One is material handling. The following process of this (large) press is precise machine processing, so we wanted the location closer to precise machines. Actually, it is impossible to place them in plants 1 and 2 because there is no allowance to put them in —and he continued...

—This heavy press makes large sounds of "Boom, Bang, Boom, Bang." Therefore, we planned to install it in the new plant 3, with special noise countermeasures in the basement. Unfortunately, we ended up failing the design of the base, you know. Another is not so important, but we had a dream to begin the production of new products in a new plant and with new equipment.

The Quality assurance staff intervened and asked Ef: —The noise and vibration problem had already found the solutions, weren't these?

— Yes, we did and finished the design of the basement already. However, these sound and vibration issues also require confirmation from the FMEA. Yes, we will also process FMEA for this matter.

—Interesting! —Hr pointed out—. Can we new members also attend these FMEA activity, can't we?

—Sure —Ef assured—. Of course, please attend everyone if you like. Sensei suggested the use of FMEA in the process of establishing the Arrow diagram. And we do this, but we are allowed so short times.

—According to Sensei, the Arrow Diagram (PERT chart) and FMEA (Failure Mode and Effects Analysis) can be integrated to enhance risk management in project management. While the Arrow Diagram focuses on project flow and task dependencies, FMEA helps identify potential failure modes and their effects. By combining these approaches, teams can effectively improve project planning and mitigate risks.

**Expansion Review after 3<sup>rd</sup> Meeting:**  
Hr: HR department staff  
Ac: Accounting department staff  
Ld: Legal department staff  
Ef: Engineering staff  
Sf: Sales staff.  
Qa: Quality assurance staff

—So —Hr concluded—, we need to make up this plan in a hurry, do we? Sensei suggested us to have one week holiday.

The surprise arose from everyone: —Holiday!?

—We should be in a hurry, shouldn't we. Holiday? —the Ac asked.

—His suggestion is a Holiday and Camp. Do you know about the term “WorkAtion”?

There wasn't such a word or concept when I was teaching this company. There wasn't the word of "Workation" at this time.

—Yes, we do. Workation?! Uhm... —Ef hesitated—. It is a good idea, maybe. Because of a study camp, which is suitable for concentrating on the job, but soon, the brain gets tired, and the thinking capacity goes down. As a result, serious oversight happens.



### WorkAtion

*The term “workation” originated from the combination of “work” and “vacation.” It refers to a blend of work and leisure, allowing employees to relax while remaining productive. Essentially, it involves working during a vacation. Workations gained popularity in the US and Europe during the 2000s, driven by the widespread adoption of laptops, the internet, and mobile broadband. In Japan, the concept started around 2015 when companies and regions began promoting workations, especially in resort areas, as part of encouraging a new work-life balance.*

*From Wikipedia*

### My story:

*When I was young, more than 50 years ago (1970s), I had a great Sensei, Sensei Nagasaki. Actually, we (the project members) were visiting the tourist destination led by Sensei Nagasaki.*

*Was the purpose tourist? ...No, not at all. It was part of the job. My previous company gave our group (project) a severe task. Thus, it was required to make up a precise action plan, including the cost calculation and profitability to investment.*

*Discussion and visibility were done using the KJ method.*

*Here is a famous tourist spot with the sea in front and a forest behind. One person whispered, and he was getting tired. Then, all members stopped thinking, changed into swimming clothes, and went straight to the seashore. And we began a barbecue party.*

*During the enjoyment, sometimes we made the dialogue and recorded ideas in the cards. One day seashore, one in the forest and another one visiting an old temple. Drinking sake (at the dinner). And in between such vacations, we developed ideas.*

*Yes, my previous company encouraged “WorkAtion” during this era. Of course, convenient tools such as the personal computer and IT didn't exist. However, even so, a workstation has merits. And, what is the merit of WorkAtion? ...It is simple. The merit is the efficiency of Creative Thinking.*

## WorkAction 1<sup>st</sup> day of 3.

1<sup>st</sup> day was spent studying the Arrow diagram led by the Ef. You may know well. Therefore, I quoted the material from SNS to save my time. If not necessary, please ignore this.)



### Arrow diagram<sup>2</sup>

The Arrow Diagram method (also known as the Arrow Diagramming Method or Arrow Network Diagram) is one of the QC 7 Tools used for planning and managing project schedules. Let's explore its key features and how to create one:

What is the Arrow Diagram method? ...The Arrow Diagram method visually represents the sequence of tasks and their durations using arrows and nodes (circles). It helps make the flow of activities and their interdependencies clear. This method is particularly useful for complex processes and large-scale projects, allowing accurate work progress tracking.



Figure 7: PERT Wikipedia [Eng]

#### Creating an Arrow Diagram:

Start by listing all the necessary tasks and their durations. Draw arrows connecting the nodes (representing tasks) in the order they need to be completed. Each arrow represents an activity, and the nodes indicate each task's start and end points. The numbers on the arrows represent the duration (in days) for each activity. The critical path (the longest route through the network) can be identified by analysing the arrows and nodes<sup>1</sup>.

#### Advantages of Arrow Diagrams:

1. Clear Dependencies: Arrows show the logical sequence of tasks.
2. Visual Representation: Easily visualize complex processes.
3. Critical Path Identification: Helps focus on the most time-critical tasks<sup>2</sup>.
4. Example: Consider a project composed of tasks A to F with the following information:

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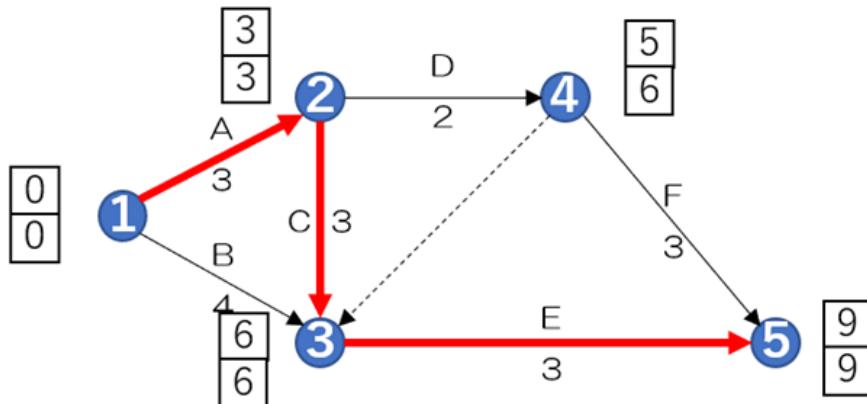
<sup>2</sup> ArrowDiagram: [https://en.wikipedia.org/wiki/Arrow\\_diagramming\\_method](https://en.wikipedia.org/wiki/Arrow_diagramming_method)

PERT Program evaluation and review technique [Eng]:

[https://en.wikipedia.org/wiki/Program\\_evaluation\\_and\\_review\\_technique](https://en.wikipedia.org/wiki/Program_evaluation_and_review_technique)

PERT Técnica de revisión y evaluación de programas [Spanish]:

[https://es.wikipedia.org/wiki/T%C3%A9cnica\\_de\\_revisi%C3%B3n\\_y\\_evaluaci%C3%B3n\\_de\\_programas](https://es.wikipedia.org/wiki/T%C3%A9cnica_de_revisi%C3%B3n_y_evaluaci%C3%B3n_de_programas)



- A: 3 days (no predecessors)
- B: 4 days (no predecessors)
- C: 3 days (depends on A)
- D: 2 days (depends on A)
- E: 3 days (depends on B, C, and D)
- F: 3 days (depends on D)

Let's create an Arrow Diagram for this project: Arrow Diagram Example.

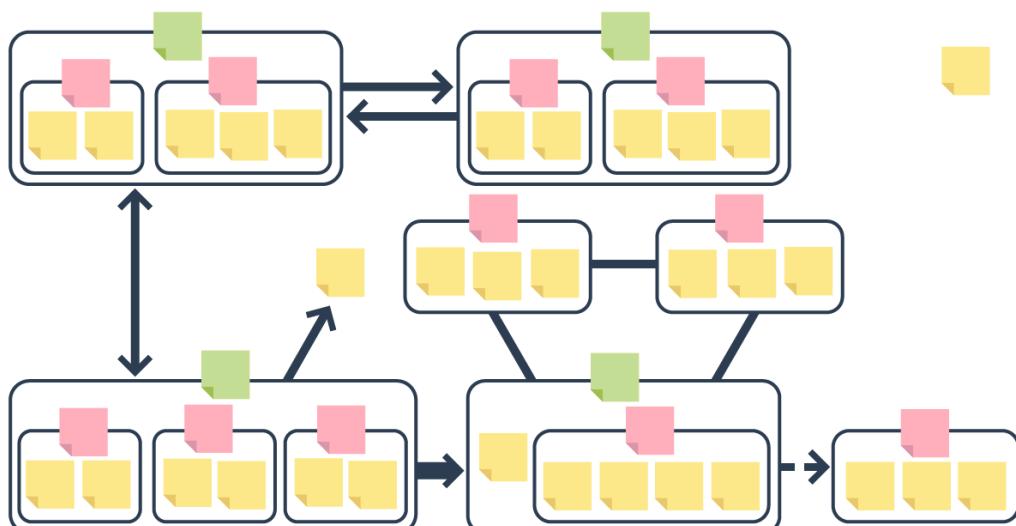
The critical path is A → C → E → F, with a total duration of 11 days.

Activities B and D are not on the critical path but are essential for the project.

Remember that while Arrow Diagrams take more time to create than Gantt charts, they provide valuable insights for managing complex projects.

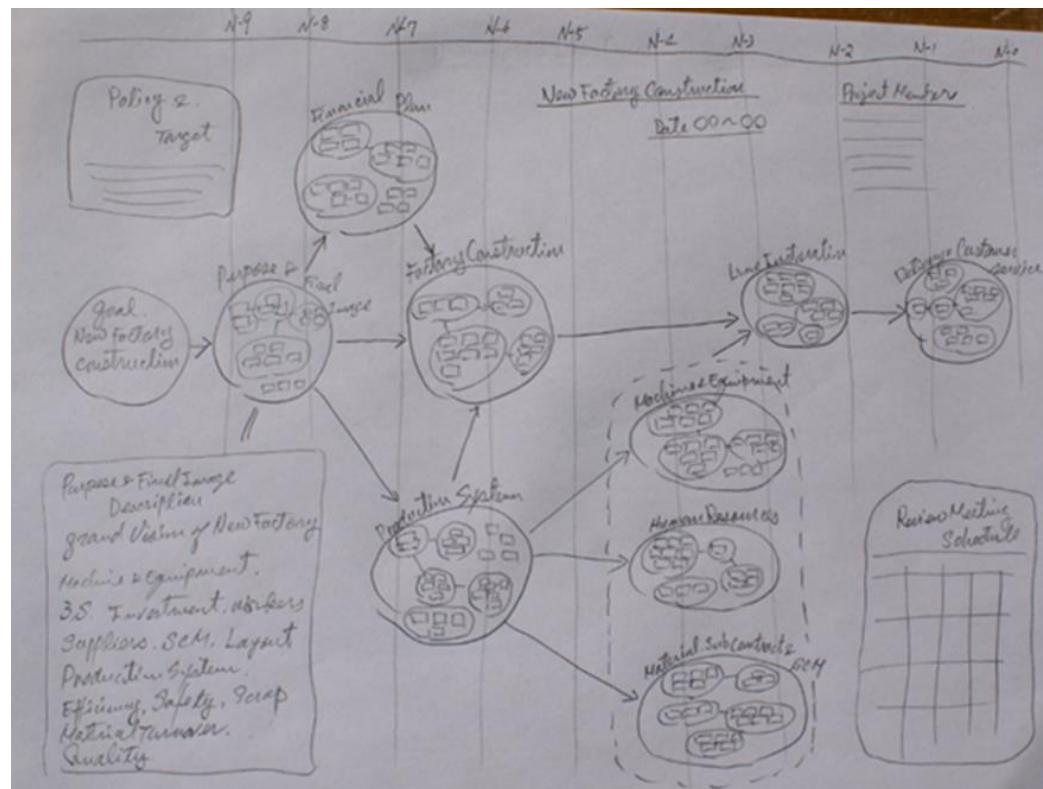
### **Now I will introduce the method I use.**

The name is KJ Arrow Diagram. It is an Arrow Diagram with the KJ Method. Next is an example of my teaching. I taught the KJ Arrow Diagram method to gain high-quality process planning when leading this project. Next is the image:



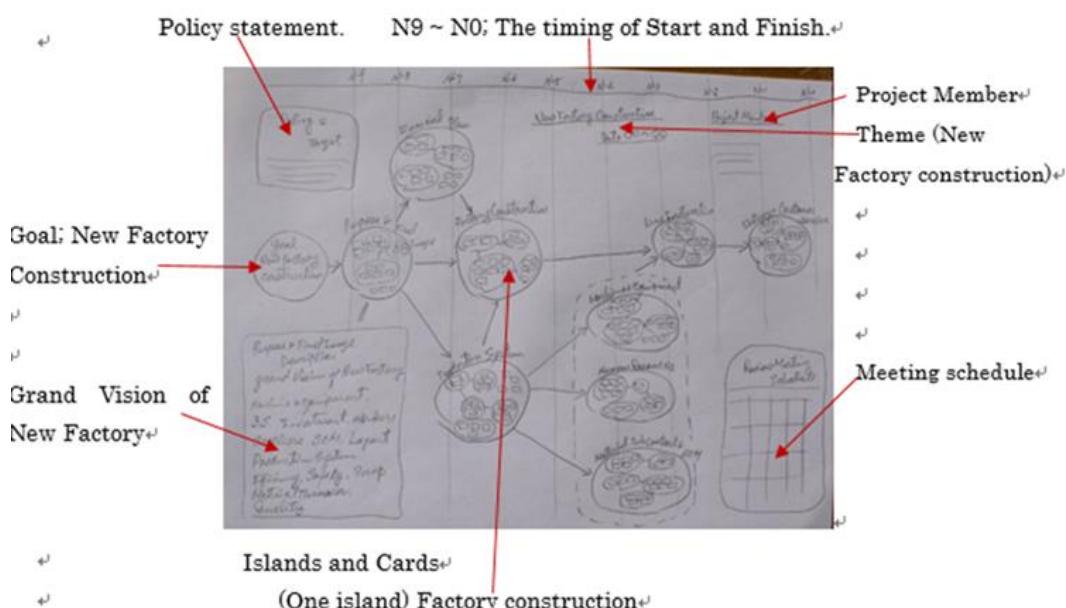
Then, I asked them to make up a KJ Arrow diagram as a piece of training.

Next is my memo on their KJ Arrow diagram training. It was intended as such, but it became the base of the final Arrow diagram.



This is the first time the team members have implemented KJ. However, when starting the activity, they showed interest and enthusiasm.

The first discussion was the purpose of new plant construction and the final image, which was based on the corporate long—and short-term strategy and annual policy. It is probably slightly difficult for you to read. Therefore, I would write down the contents.



This is the image of the KJ Arrow Diagram. This is an application of the KJ method and arrow diagram, such as a PERT Chart.

### **KJ method**

*The KJ Method is an idea-creation method developed by Jiro Kawakita. Look at the above picture. It was indeed good training for them. They needed to create high-quality Arrow diagrams as soon as possible.*

*They had no room for spending time. But there is the word "More haste, less speed"(Slow and steady wins the race)... They could gain the eyes to look at the overall view and the capacity to focus on individual work items.*

*Now, I will explain the above picture (KJ Arrow diagram). This is still the training, but not the final Arrow diagram scheduling.*

- Project aim: New Factory Construction and New production line introduction.
- Term: 10 months from the establishment of the project to delivery start. (N-0 ~ N-10)

### **The contents of this diagram:**

*Firstly, this project confirmed and write down following 3 things.*

- 1) Policy and Target
  - a. Policy statement.
  - b. Target: Safety, Production volume, Quality, Delivery and Cost.
- 1) 2) The goal: New Factory Construction.
- 2) Purpose and Final Image (Grand vision of New Factory)
  - a. Very small production lot size & LT (Lead Time), Enjoyable by workers,
  - b. Quick response to customers and Good cost performance factory & line.
  - c. In considering.
    - i. Machine & Equipment, 3S (Customer's Satisfaction, Employee's Satisfaction and Society's Satisfaction), Investment, Number of workers and Gemba organization, Suppliers & Material SCM (Supply Chain Management), Layout, Production & Control System and KPIs (Safety, Quality, Efficiency, Scrap ration, Material turnover ratio etc.) and virtual pictures & photos (as the image).
    - ii. Particularly the use of Sensors, Edge computer. AI and Robotics.
    - iii. Edge Computer; computer network by process computer. (At this time, there wasn't such IoT, AI and Robotics.)

### **Then this project started the discussion in KJ.**

*In fact, in this project, three additional support group activities were established. One was a financial backup group. One was an IPQC (Initial Products Quality Control) group. The last one was a TPS (actually, a Kanban system) group. I will describe IPQC in a later chapter. But here, I omit the explanation about these.*

*So, let's look at the KJ Arrow diagram (training) step by step.*

### **Step-0. Necessary construction works assumed (assumed medium islands).**

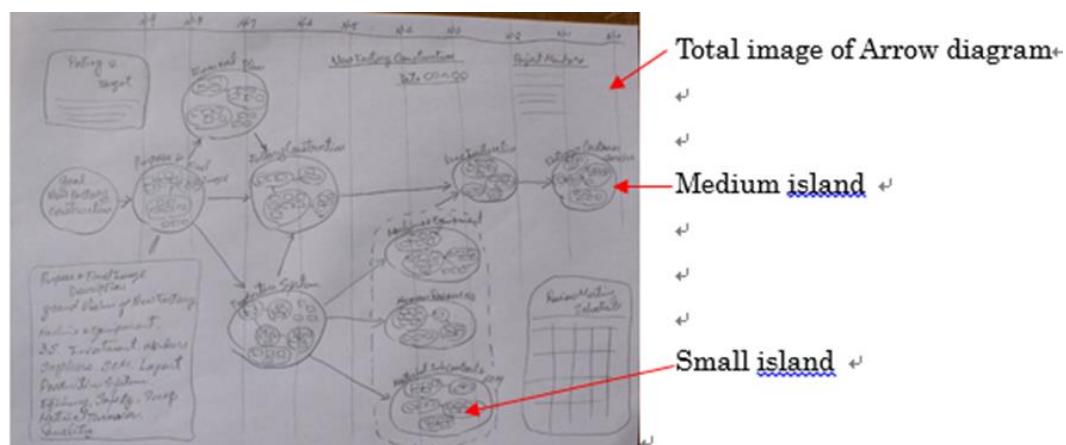
This company's construction was done with the ideas of the previous project group. This included 500-ton press installation, factory construction, layout plan, precise equipment installation, etc. If starting from zero, the outline of construction works should be discussed and items listed.

### **Step-1. Creation of cards (Label Okoshi)**

They created the ideas of necessary things & works in the card for individual assumed construction works.

#### The frame of Arrow diagrams.

- Arrow diagram: It is used to calculate total LT (Lead Time) and for presentation.
- Medium islands Arrow diagram: this group decided on 17 medium islands. Each medium island is calculated as the individual construction work LT and total. It is constructed of small islands. Identify the relation of pre, and post-processing using arrow marks.
- Small islands: These are the necessary construction work units.



### **Step-2. Displaying in a big paper.**

1 to 3 cards (the smallest work unit) with the relation are in one island.

### **Step-3. Adding cards.**

Discuss the contents of each card and create the additional ideas and cards and the display layout. Also, add a medium island idea (If there is one).

### **Step-4. Titling each small island.**

Discussing the title (naming) of each island. This title is the minimum unit of necessary activity (construction work).

### **Step-5. Cutting out the small (minimum) islands.**

...It is possible to omit this process if you have good skill of KJ.

*This group had its first experience with KJ, and also, there are so many cards and necessary construction works (small islands). Therefore, this process was implemented.*

**Step-6. Discussing the display layout about each other.**

**Step-7. Deciding medium islands.**

*Grouping small islands and deciding the unit of medium islands and the title (In this case, up to medium islands were made.)*

**Step-8. Cutting out the medium islands.**

*...This step is also possible to omit in case you have deep experience with KJ, but I suggest doing this process if there are many cards and small islands.*

*Of course, this group implemented this. Here, I introduce their ideas (small islands).*



**Cutting medium islands to consider the placement.**

*Next is from TQM-5. KJ Method.*

*It is recommended if you are a beginner in KJ or affinity diagrams. Each middle-sized island is considered one island. Then, it is considered the affinity of each other. The cards were already pasted. However, it is necessary to consider flexibility. Cutting out middle-size islands and considering the layout in affinity with each other is a good idea.*

*Then, re-layout the middle-size islands in considering the affinity.*

*The relation lines are drawn to identify the middle-sized islands.*



*Cutting the medium size islands.*

*Think about the affinity (relation of before and after) with each other.*

*Medium island cut. I'll write this as I go, but feel free to skip it if you like.*

*Then, a total of 32 medium islands were made.*

*Confirmation of policy, Safety assessment, Environmental Assessment, Building construction schedule, Installation of 500-ton press. Installation of precise machines, Construction of baking oven & handling, Logistics consideration, Sales expansion measures, Investment plan, Layout and material handling, Assembly method reconsideration, Necessary tools and its development, Cooperation of 1,2,3 plants, Worker training, Quality control of kiln-fired products, Temporary offices and parking lots for construction companies, Re-examination of wastewater treatment facilities, Legal Considerations of wastewater treatment facilities, Dust countermeasures for Polishing machines, Process FMEA.*

---- *The rest is omitted.* ----

### **Step-9. Deciding procedure of medium islands.**

*This process requires careful consideration. Thus, it is work that can be done independently. Construction work with pre- and post-processes.*

*The works that can be done independently are written outside of the KJ Arrow diagram.*

*As you understand, the objects of the Arrow diagram are "Work with pre and post-processes." And identify the relation of medium islands to each other.*



### **The success of the KJ Arrow diagram. The end of the three-day WorkAction camp**

I wrote as above. However, this process is the most important for establishing a complicated process, as shown in the Arrow diagram. It is never a bad idea to invite professional people, for example, the staff of construction companies and precise equipment manufacturing companies.

When making the Gantt Charts, inviting and hearing the opinions of such 500-ton press were already done. However, once again, it was implemented.

—It is amazing —some of the inviting staff to the meeting—. Indeed amazing. We have never seen such an Arrow diagram.

1. This was their impression when they saw the vast KJ Arrow diagram, which had already completed the layout of the cut-out medium islands.
2. Then, Ef took a photo of the distributed KJ Arrow diagram to keep the record. This is a temporary placement.  
After explaining the distribution of medium islands, Ef explained the contents of individual medium islands to gain additional necessary work.  
There were some opinions, but not many. The islands were modulated by adding or correcting cards.
3. Re-distribution of medium islands with listening to professional opinions. The purposes are, of course, to avoid missing items and (more than anything) to shorten the lead time.

#### **Expansion Review after 3<sup>rd</sup> Meeting:**

**Hr:** HR department staff  
**Ac:** Accounting department staff  
**Ld:** Legal department staff  
**Ef:** Engineering staff  
**Sf:** Sales staff.  
**Qa:** Quality assurance staff

During the coffee break, the professional members questioned: —Why did you come up with such cards using an Arrow diagram? —asked some of the professional staff invited.

—"Come up with!" —the Legal staff mentioned—, Yes, this answers your question. Why are we doing work? Why use cards combined with Brainstorming? Why diversity? We (Ld, Hr and Ac) are not professionals in construction works or plant equipment.

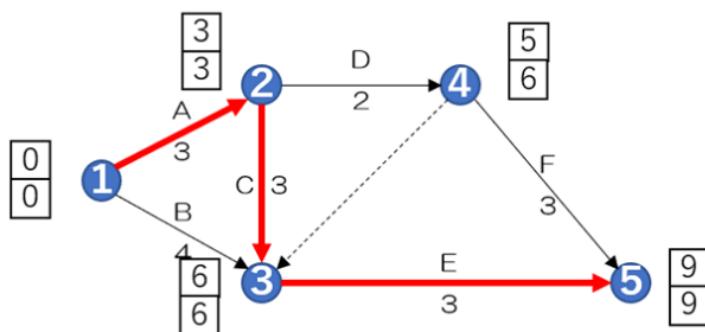
—But we can gain important "Come up with" in extensive view —The Ef Mentioned.

I rather omit the rest of the conversation.

4. Revisit and summarise islands: At this point, the three days of WorkAction were over, and they returned to the company's conference room to continue the discussion. The professional persons invited to the WorkAction were also invited to this conference.

#### **Step-10. Each medium island's KJ Arrow diagram.**

The construction working days of the 17 medium islands should have been decided in a hurry. For instance, in the picture below, this medium island has 5 construction works.



The reasonable working days were negotiated. For instance, from the start (1) to (2), the working days are 3 days. The completion of construction works took 9 days.

This example is not a real object. It is not possible to show it because of the confidential contract. However, it discusses the necessary lead time and the relation of each medium island. And with the construction companies, a very hard negotiation to the companies was made.

The important things of Arrow diagram creation are as follows:

- a. Not to overlook the necessary items.
- b. Relation of necessary items.
- c. Total and individual LT reduction.
- d. Deciding the Critical Pass (A-C-E-F; total 11 days).

#### **Step-11. Deciding the construction work procedure of medium islands.**

Relation of 17 medium islands each other and the timeline of construction works.

The following Step-12 is omitted as it contains the same content as Step-10.

**Step-13. Drawing the arrow marks and displaying the target date on each island.**

**Step-14. Deciding the index makes it possible to judge whether the situation is complete or not for each medium island.**

**Step-15. Charting. Finding the Critical Pass, Calculating the total LT and confirming the construction completion date.**

Return to the negotiation process if you do not achieve the target date. Then, this big chart's medium and small island items were reflected in the action plan paper.

### Islands:

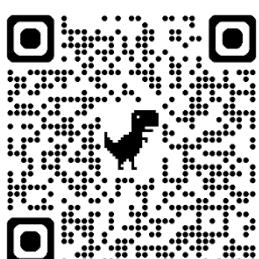
This master diagram has 14 islands, from Policy and Target to Review Meeting schedule (including the "Goal"). For instance, Purpose & Final Image: Some words are on the island. These are the Grand Vision of the New Factory. Other islands also have cards created in the KJ-Method.

### Ideas of necessary activity (process) in the diagram.

Policy & Target with policy statement is easy to write down. This is the flag or banner of the project.

Purpose & Final Image: In front of the (for instance) prototype, drawing, photos of machines, KPIs of current production lines, customer information, suppliers, financial reports and the policy statement & target, the discussion in KJ is made.

This process is essential to identifying the goal and sharing the image of the final goal. Since it concerns the construction of the new factory, it is necessary to look at it from a broad perspective.



### KJ Discussion:

- No criticism, No neglect of cards.
- Creating ideas from the words of other persons.
- Writing short & concise sentence.
- One idea in one card.

Now that you understand, I use KJ to make arrow diagrams.

**Example of a defect analysis:**

Figure 8: TQM-5 [Eng] The

KJ-Method

- Layout the islands in the diagram.
- Naming of islands. Arrow of relation and order.

**From TQM-5. KJ Method<sup>3</sup>**

I omitted the detailed explanation of KJ because I explained KJ deeply in the previous chapter.

And when making the action plan of the above New Factory Construction, the steps are:

- 1) Hold grand discussions in KJ and confirm the grand vision of the new factory.
- 2) Based on this grand image, discuss the necessary processes (title or name of each island: financial plan, Production system, etc).
- 3) Discussing detailed processes of each island (involving relevant sections).
- 4) Individual islands are required to make process diagrams, which have the same form as the grand diagram.
- 5) Process time: Each island is required to estimate the process time.

The islands are laid out in the grand diagram considering the relation and the time. Therefore, a Grand Diagram is vast and is highlighted in the Gemba as a master plan.

**Now the critical points.**

1. Clear purpose and goal defining.
2. Sharing the purpose & goal and final image.
3. Write down the process & order in the cards collected as much as possible.  
Also, write down the necessary things (required conditions to reach the goal) in KJ.
4. Deciding the judgement criteria to be allowed to move to next in each process.  
"Check the process implemented as planned" in each criterion.
5. Feedback ideas, lack of process or necessary activities in masterplan and individuals. (If there is a lack of additional ideas, please let us know.)
6. Standardize the process of thinking for the future.

**Now, I introduce the contents of medium islands as follows.**

- 4) **Financial Plan:** Investment, Financial feasibility study etc.
- 5) **Factory Construction:** Space, Layout image, construction etc.
- 6) **Production System:** Kanban, Andon, QRQC (Quick Response Quality Control), Edge Computer (If now, IoT, and AI & Robotic introduction) etc.
- 7) **Machine and equipment preparation:** necessary quantity, Jigs and tools, Robots, Feasibility study (in trial with small investment), QC Process Chart, Process FMEA, real-time quality and production situation feedback with IoT, SMED (Single Minutes Exchange Die; Quick Changeover system including full & semi-automatic changeover, etc.
- 8) **Human Resources:** Number of workers, Gemba organization, Training, Skill control, TPS (Total Preventive Safety) etc.

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<sup>3</sup> TQM-5 The KJ-Method [Eng]: <https://archive.org/details/tqm-5-the-kj-method>

TQM-5 El Método KJ [Esp]: <https://archive.org/details/tqm-5-el-metodo-kj>

- 9) **Material, Subcontract & SCM:** QC Process Chart, Supplier Evaluation, Information feedback system, Material handling in IoT link etc.
- 10) **Line Installation:** QC Process Chart, Line installation, Safety check and evaluation, Real-time feedback of quality and production situation in IoT, Production scheduling in AI (Reduction of scrap loss and changeover frequency in tiny lot production and demand), machine-concentrated area (abandon the SEIRYU-KA flow), WIP conveyance with robot, trial run, etc.



### **SEIRYU-KA flow.**

*In the Making Stream of Production<sup>4</sup>, I described the SEIRYU-KA flow as one of the making production flow methods and one of the TPS methods.*

*I also told them it is a good system if the company has many machines with the same function and surplus capacity.*

*SEIRYU-KA system requires setting up the production line with specialized machines (for the products and similar products) in an array.*

*If the company is not in such a condition, this system is not recommendable because it wastes investment and causes production troubles.*

*This project targeted very frequent handling (conveyance) by material handlers rather than SEIRYU-KA, after the discussion of manual handling (choko-choko handling: small lot and frequent handling).*

- 11) **Project member and photos:** Members' names with photos and support organization.
- 12) **Review Meeting Schedule:** Grand review by top, Departmental review, Project meeting and with record.

In here, I write 3 other support team activities which are not included in this KJ Arrow Diagram:

- 1) One was the Gemba's Hiyari-Hatto committee (**safety committee in Gemba**). The aim of this committee was:
  - Hiyari-Hatto in Safety. And,
  - Hiyari-Hatto in Quality and troubles.
- 2) Choko-Choko material handling system by Kanban and the handling equipment.
- 3) PM study team (mainly the 500-ton press and new precise machines).

...I'd omit the detail...

<sup>4</sup> **Making the stream of production 0.. 14 [eng]:**

[https://archive.org/details/makingstreamofproduction13\\_202001/Making%20stream%20of%20productio%200%2C%20The%20way%20of%20TPS.%20Introduction/](https://archive.org/details/makingstreamofproduction13_202001/Making%20stream%20of%20productio%200%2C%20The%20way%20of%20TPS.%20Introduction/)

**Estableciendo la corriente de producción 0..14 [esp]:**

[https://archive.org/details/establecerlacorreo13\\_202001/Establecer%20la%20corriente%20de%20producci%C3%B3n%20El%20camino%20de%20TPS.%20Introducci%C3%B3n/](https://archive.org/details/establecerlacorreo13_202001/Establecer%20la%20corriente%20de%20producci%C3%B3n%20El%20camino%20de%20TPS.%20Introducci%C3%B3n/)

Finally, it only mentions that this is my method for creating a high-quality action plan, particularly for process confirmations.

Again, one of the essential factors for a project's success is making a high-quality action plan. The objective of "Check" is not collecting statistical data but the process and judgement of what to move to next.

Suppose the project requires an expensive investment (such as new factory construction and the introduction of costly new machines). In that case, the feasibility study must consider the fiscal possibility and the cost to effect.

The feasibility study uses the PDCA cycle. However, the Deming cycle is inadequate in a big project where trial-and-error is not allowed.

## Process Confirmation

By the way, in this project activity, I made another interesting activity. I would introduce it for your reference: The purpose is to make the particular process conformation.

In fact, I was teaching TQM at the time. For this theme, new factory construction, I required the students to take the "Function Deployment" approach in the course.

Of course, I was required to use the KJ Method to make "Function Deployment." I usually teach this method as a TQM tool. However, I was required to use it for the construction of the new factory. They enjoyed this activity very much.

**The theme:** New Factory Construction and Production Line Introduction.

- 1) What is the function of the new factory? ...Base stage function.
- 2) What are the necessary functions and conditions for the primary function? ...First stage.
- 3) What are the necessary functions and conditions? ...Second stage function.
- 4) ...

This is a game. However, in this game, they can understand that it is necessary to look at things that are assumed from a broader perspective. I will describe "function deployment" shortly.

Then they made the pyramid of the Function Deployment. These cards in the pyramid were also added to the KJ Arrow Diagram. Of course, many cards were duplicated to the original KJ Arrow Diagram. However, all cards of the Function Deployment pyramid were added without neglect.

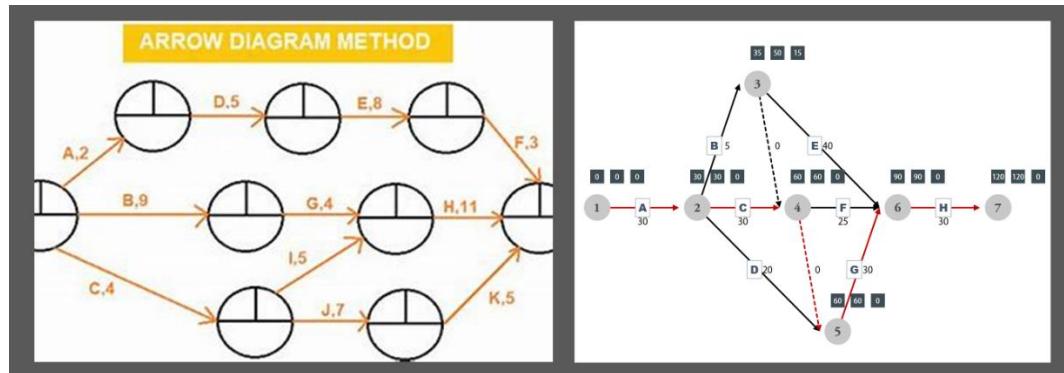
The examples of cards added:

- Colour identification of dangerous points in the machine,
- Colour identification of WIP (work in progress) after changeover,
- Effective route of visitors in factory layout,
- Skill training area and skill evaluation board in layout,
- Rest area and lighting and facilities,
- Material handling system for tiny lots and frequent change-over
- Etc.

## Steps in an Arrow Diagram

By the way, I explained the necessary steps but didn't explain the drawing method of the Arrow diagram itself.

I believe it is not necessary to do it because you can gain better teaching from SNS. For instance, Excel also has drawing tools. Please refer to these, if you like. Thus, the next one is an example of EXCEL.



Also, the method is introduced in YouTube. As you understand, the important things are not such tools, which can gain conveniently from SNS, but Creativity, Innovative thinking, Imagination, Idea generation.



## PERT Diagram (Program Evaluation and Review Technique)

How different are the Arrow-diagram and PERT diagram? ...It's ridiculous, so I won't write it down, but please refer to the following lines if you like.

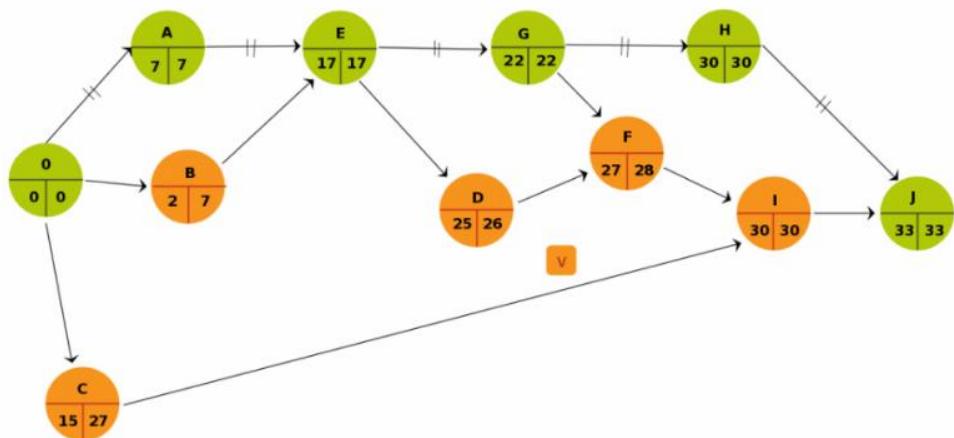
*The differences between PERT diagrams and Arrow diagrams.*

**PERT Diagram:**

*PERT diagrams are used for project scheduling. They represent events (milestones) and tasks (activities) as nodes, connected by arrows to show dependencies. Each activity includes an estimated duration (usually a range from shortest to longest).*

*"PERT diagrams are helpful in creating schedules that consider uncertainty."*

Activity	Duration (in days)
A Prepare foundations	7
B Make & position door frames	2
C Lay drains floor base & screed	5
D Install service & settings	8
E Erect walls	10
F Plaster ceilings	2
G Erect roof	5
H Install door & windows	8
I Fit gutters & pipes	2
J Paint outside	3



### Arrow Diagram (also known as Arrow Diagram Method):

Arrow diagrams are network diagrams used in project management. They represent tasks and their dependencies using arrows. Each activity includes a specific duration.

“Arrow diagrams focus on the sequence of activities and their interrelationships.

In summary, PERT diagrams account for uncertainty, while arrow diagrams emphasize task durations. Both are valuable tools in project management!

**By Being COPILOT**

Do you understand? ...Anyway, KJ Arrow Diagram can be used for any project management.

## Process FMEA



I will write about this topic in a later chapter.

### III. Jishu-Ken in the Teaching Company (continued from TQM-7<sup>5</sup> <sup>6</sup>)



#### 2<sup>nd</sup> Jishu-Ken. Continuing the study in BEP analysis.

It was started from an idle talk... Even so, it was an intense (vehement) meeting (Monthly management meeting) and its discussion. As a result, our presentation was successful, and our suggestion of the product's sales price, \$100M, was accepted. Even so, the 100 USD (MpR) Marginal profit rate is 10%. 10% it is! The expected marginal profit is only 5,000 USD, and the large deficit is -15,000 USD.

Just as we imagined, Mr. Production Director became pale. However, there is no other choice without selling the M inventory at such a price.

—Mr. Em, when was the quality level so bad? —I asked him.

—In the past, there was a period when the quality level improved well. But after finishing the company-wide activity, it became worse. Additionally, as you feel, the line workers are replaced

Numeric value-2-P/L		
Item	Formula	Value
Sales volume	G	500
Sales amount	H=GxA	50,000
Fixed cost	I=D	20,000
Variable cost	J=GxB	45,000
Variable cost + Fixed cost	K=I+J	65,000
Marginal profit	L=H-J	5,000
Profit & Loss	P/L=H-K	-15,000

<sup>5</sup> **Cost reduction/control** is a series of lectures about the interpretation of different costs regarding calculating the Profit and Loss statement adequately depending on the activity and policy of the company:

- Cost Reduction – 7: [eng] <https://archive.org/details/tqm-5-the-kj-method/page/n47/mode/2up>
- Cost Reduction – 6: [eng] <https://archive.org/details/tqm-3-hardware-software-diagnose-cost-reduction-6>
- Cost Reduction – 5: [eng] <https://archive.org/details/tqm-2-introduction-2-cost-reduction-5>
- Cost Reduction – 4: [eng] <https://archive.org/details/tpm-16-oil-control-5/page/8/mode/2up>
- Cost Reduction – 3: [eng] <https://archive.org/details/tpm-15-cost-reduction-3-and-consultancy-job-continuation>
- Cost Reduction – 2: [eng] <https://archive.org/details/tpm-14-clasification-of-cost-and-oiling>
- Cost Reduction – 1: [eng] <https://archive.org/details/tpm-13-oil-control-3/mode/2up>

<sup>6</sup> **Teaching Company** is a series of a real story about the implementation of TPM and TQM in a medium-sized company by **Sensei** Kimura. They are deployed throughout TPM-7 to TPM-16, which continues within this TQM series. The beginning of this series is in TPM-7:

- [English]
  - TPM-7 page 31 One Lecture in a Company:  
<https://archive.org/details/TPM7SeisoInJishuHozan/page/n29/mode/2up?view=theater>
  - Previous lecture in TQM-7. Page 33: <https://archive.org/details/tqm-7-7new-qc-tools-and-the-tree-diagram/page/n31/mode/2up>
- [Spanish]
  - TPM-7 page 31 Una conferencia en la Empresa:  
<https://archive.org/details/TPM7SeisoEnJishuHozan/page/n29/mode/2up?view=theater>
  - Lectura previa en TQM-7. Page 33: <https://archive.org/details/tqm-7-las-7-nuevas-herramienta-de-caliad-y-el-diagrama-de-arbol/page/32/mode/2up>

by increasing worker turnover. The quality assurance system didn't take proper countermeasures even with such workers' conditions.

—I wonder, what will happen after this? —I asked.

The Engineering Section Manager answered my question: —Anyway, earning and increasing the marginal profit is necessary because we have the risk of cash-flow shortage. And Mr. MD brought Sensei Kimura back.

—Cash flow —repeated the Hr—. I was shocked. Lack of cash flow in our company!? We are going to Bankruptcy cause of No cash!? I learned the meaning of Bankruptcy in Black in a book. It is said the following: We say, "bankruptcy in Black." This refers to a situation where a company goes bankrupt due to cash-flow problems even though it is profitable.

—Actually, our company is not in the situation of "Bankruptcy in Black," but even in a worse situation. We have double conditions: "not in Black but Red" and lack of cash flow.

The Sales Section Manager agreed: —Yes, we believe our headquarters (parent company) would continue the money supply. Therefore, I didn't feel such a severe situation. So, I cannot understand the situation of "Bankruptcy in Black." Of course, I know the situation of Bankruptcy in Red. Even though financial contents are in Black, a company becomes bankrupt. Why?

—The cause of "bankruptcy in black" is usually caused by the following factors —the Hr described—: Firstly, an Excess debt: If a company has a large debt, it may be challenging to pay it back even with profits. This is a common cause of profitable bankruptcies. Our factory is in this situation and has accumulated debt.

—Secondly—the Hr continued—, a Management failure: If the management team fails to develop a proper strategy and operate efficiently, the company may face bankruptcy. Also, we are in this situation, aren't we?

— Thirdly, some Economic fluctuations and market changes can affect a company's earnings. This can be caused by economic downturns or the rise of competitors.

—Moreover, there are some others, like legal issues, such as legal disputes, litigation, regulatory violations, etc., all of which can adversely affect a company's operations. Fraud: This can be due to accounting fraud, misappropriation of funds, or misconduct by management. In addition, combining these factors can cause a company to go bankrupt.

—Come to think of it (Bankruptcy in Black) —the Production Section Planning pointed out—. In my experience, two profitable manufacturing companies went bankrupt in my hometown, one

located in front of the station and the other in the next town. These are typical bankruptcies in black. Company A's finances are in the black, but he looks like he'll go bankrupt due to excess lousy inventory. An insufficient inventory can cause an inadequate cash flow. Our company also fell in bad inventory turnover. Mr. AD shouted, "We have no cash! Our cash is frozen in the warehouse!" —and Hr continued...

—Company B's finances are in the black, but he also looks like he is going bankrupt due to the lack of cash flow.

**2<sup>nd</sup> Jishu-Ken for Break-Even Point Analysis. Teaching Company.**

**Sm:** Sales Section Manager

**HR:** Human Resources Manager

**Em:** Engineering Section Manager

**Pm:** Production Section Planning Mngr.

**Mp:** Material Section Procurement Manager

**Af:** Accounting Staff

—Anyway, Em tried to calm down. I was surprised by Mr. AD's remark. Then, we need to be more severe about management and financial issues. No, no, no. We were serious about them. However, we probably felt it was someone else's problem.

—Even more —the Hr dive deep into the same argument—, there is no reason not to go bankrupt because of a lack of cash flow and financial red.

The exposition of facts and opinions continued for a while when the Engineering Section Manager intervened again: —Ok, everyone —he tried to wrap up the nonproductive discussion—. Now, please, here is the honest debate: The theme is: Why marginal profit management? And what is the difference between Marginal profit management and Throughput management?

—Firstly, according to Mr. Af's advice, there seems to be no such term as Marginal Profit Management. On the other hand, there is the term Throughput Management in TOC.

— “Throughput Management” is used in business and operations management. It refers to managing and optimizing the rate at which a system produces output. According to a book, Throughput management is referred to as next. In the business context, throughput management involves strategies and practices to maximize throughput, which is the amount of a product or service that a company can produce and deliver to a client within a specified period. This can involve identifying and minimizing bottlenecks, improving efficiency, and using resources better.

—There is no term for Marginal Profit management. Why? —asked the Mp.

—I interviewed Sensei Kimura and Mr. AD about Marginal Profit management —the Em answered—. Then, I was told there is no term of Marginal Profit management, or it is not popular worldwide. And Mr. AD continued as next: "However, we chose this as our main strategic pillar." And Sensei Kimura showed his experience with his P/L Statement below: Monthly P/L Statement (From TQM-2)

P/L Statement		
Subjects	Remarks	Note
1 Sales amount & Sales KMH(Kilo Standard Hours)		Actual amount & sales products x Standard H/P
2 Planned Labour Cost		$\Sigma$ Product Sold x SH x Standard Unit Labour Cost
3 Planned Material Cost		$\Sigma$ Material Used in Sold x Planned Material (Standard) Cost
<b>4 Planned Marginal Profit</b>	$4=1-(2+3)$	Marginal Profit=Sales amount-Variable cost
5 Actual Labour cost		Actual working hours x Planned unit cost + Achieved Efficiency
6 Planned Labour Cost		Same to 2.
<b>7 Labour Cost Modification</b>	$7=5-2$	
(Labour Efficiency, Planned & Actual%, Repair Cost Quality Defect Ratio, Actual & Plan of Production KMH )		
8 Actual Material Cost		Actual result of material cost.
9 Planned Material Cost		Same to 3.
10 Loss disposal of waste (Loss rate, Planned & Actual %)		the part of material cost. Actual material scrap loss.
<b>11 Material Cost Modification</b>	$11=8-3$	
<b>12 Direct Cost Modification Total</b>	$12=7+11$	
<b>13 Outsourcing Cost</b> (Outsourcing, Planned & Actual KMH)		Treated as Direct Cost and Variable Cost
<b>14 Actual Marginal Profit</b>	$14=4-12-13$	
15 Direct Expenses		Other than Outsourcing (Metal mold, Tools, etc.)
16 Factory (Manufacturing) Overhead		Indirect Material, Indirect Labour and other Indirect Expenses (Machine & Equipment Depreciation)
<b>17 Gross Profit</b>	$17=14-(15+16)$	Sales commission, sales promotion cost (advertising cost)
18 Selling Expenses		Personnel costs (salaries, bonuses, various allowances) for indirect departments, costs for operating the office of indirect departments etc.)
19 General and administrative expense		
<b>20 Operating Profit</b>	$20=17-(18+19)$	
21 Non-Operating Income		
22 Non-Operating expense		
<b>23 Ordinary Profit</b>	$23=20+21-22$	
24 Extraordinary Income or Loss		
25 Tax		
<b>26 Net Profit</b>	$26=23-24-25$	

**2<sup>nd</sup> Jishu-Ken for Break-Even Point Analysis. Teaching Company.**  
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Below is the conversation with Sensei Kimura and Mr. AD:

—Mr. Em. Very good. You and your team started the self-education (Jishu-Ken), which I greatly appreciate. Your theme now is why top management decided to pursue marginal profit in the term Marginal Profit Management, isn't it? I incorporated the use of Marginal profit management as one of the target control items.

—The above is an example of my division's P/L statement. As you can see from the above example, I managed my division to maximize the marginal profit by reducing both sales and variable costs and comparing these against the yearly budget target.

The AD intervened: —Marginal Profit "management". In fact, there is no popular term for Marginal Profit management in the world. However, we use this term. Why is it not popular in the world? In just my point of view, Marginal Profit that is one of the financial indexes which is a result. Yes, it is a financial past result. Then, we decided to use it for the target management item by adding the term of "management" to it. Marginal profit is one of the earning capacity (Profitability capacity) index. And we decided to plan to improve earning capacity as a main pillar. Understood? Once again, it is the number of "past" results, but not to be planned in the business management planning, in general. However, we decided to involve the plan of earning capacity improvement in our strategy.

—Therefore, Marginal Profit "management" term isn't popular worldwide. On the other hand, the term Throughput "management" is known worldwide.

—Marginal profit and Throughput are almost the same in the numbers. However, there are different concepts in Marginal Profit and Throughput. While the Throughput Management and Marginal Profit Management share similarities in their focus on optimizing profitability, they are not exactly the same concept. Throughput management primarily emphasizes maximizing the flow of products or services through a system to generate revenue. In contrast, marginal profit management focuses on analyzing the incremental profit generated by each unit of production or sale.

The Em showed a surprised face and questioned: —Eh???? Both are almost the same in numbers, but different concepts. I don't understand.

—Ha-ha-ha! —I laughed—. It is indeed ambiguous. I also don't understand how different our Marginal Profit Management and Throughput Management are. No, now it is clear. It can be said when adding the term Management To Marginal Profit, the term Marginal Profit Management can be the same concept as Throughput Management. Maybe, ha, ha, ha! But it is not so important how different these are. The most important thing is to improve the Marginal Profit or Throughput, whether it is called Marginal Profit management or Throughput Management.

By the way, the concept of Marginal Profit management (or Throughput Management) isn't new but old. For instance, do you know the Japanese company KYOCERA? They have been using this concept in management since the 1980s. I have also been using it for 40, or 50 years before.

*—Oh. Really? —Em questioned, surprised—; we believe that Throughput thinking is Dr. Goldratt's gift of research. Oh, really?*

*—Oh, yes. Such thoughts and operations existed in Japan more and more before him. In reality, I also managed my previous division with this thought since the 1980s and taught in companies. Therefore, Throughput or Marginal Profit management is not new to us. However, please take care; the Throughput and Marginal Profit are a little different regarding strict interpretation. But. It is possible to neglect the operation. So, please check how different these are in your Jishu-Ken.*

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Going back to the *Jishu-Ken*, the *Em* intervened: —Above is the interview's contents to Sensei and Mr. AD. Once again, we decided on the Marginal Profit management policy for more sound financial content. Now, we need to understand the term Marginal Profit Management and the keywords "Sound Financial Content" and "entire optimization in TOC."

—Very well Mr. Em —the Hr mentioned—. According to the book TOC (Theory of Constraints), Throughput management also targets an "Entire Optimization (Best in Entire)".

—Clearly, Marginal Profit "Management" and Throughput Management are very similar. But are there different points, aren't there? I compared both. First, the comparison of formulas. The formulas of Throughput and Marginal Profit are as follows —he said and wrote them on a whiteboard:

$$\text{Throughput} = \text{Sales amount or Output} - \text{TVC (True Variable Costs)}$$

And;

$$\text{Marginal Profit} = \text{Sales amount} - \text{Variable costs}$$

—Then, I had a doubt —the Hr pointed out—: What are the different Variable costs in Marginal Profit and True Variable costs in Throughput? ...I compared both variable costs with the help of Mr. Af The next picture is the result.

Variable cost of Marginal profit and TVC of Throughput		
Items	Marginal profit	Throughput
Raw material	Yes	Yes
Outsourcing	Yes	Yes
Direct labor	Yes & No	No
Purchase parts	Yes	Yes
Electricity, Gas, Water, Air, Lubricant	Yes	Yes
Machine spare parts & Maintenance supplies	Yes	Yes
Safety protective equipment	Yes	Yes
Packaging materials	Yes	Yes
Transportation	Yes	Yes
Sales commission	Yes	Yes
Others related directly to sales and production	Yes	Yes

—What are the contents of Variable Costs? —asked the Af.

—Humm??? —Pm hesitated—; Almost the same without the item of Direct labor costs.

—But, it is a big difference—described the Hr— Direct labour costs included or not included. In general, the costs of raw materials, purchase parts, outsourcing, and direct labour are the largest in total. In other words, even though other variable costs are neglected, there are no big influences. And direct labour costs are the next largest after raw materials...

—In general, Throughput accounting doesn't involve Direct labor cost in it, but involved in Operating Expenses. Once again, the formula of Throughput accounting and Profit are:

$$\text{Throughput} = \text{Sales amount} - (\text{Materials} + \text{Outsourcing})$$

$$\text{Profit} = \text{Throughput} - \text{Operating Expenses}$$

$$\text{Profit of Marginal profit} = \text{Marginal profit} - \text{Fixed costs}$$

—And, the item of Direct labor costs is involved in this Operating Expenses.

The Em agreed: —I also confirmed it. For your reference, I will show you next which excerpt of a book:

*"True Variable Costs (TVCs) include only costs that vary directly with production volume.*

*Direct labour costs are not considered part of TVCs in throughput accounting.*

*The assumption is that workers are paid on a fixed rate basis or salary basis, not based on a piece-rate system."*

—Therefore, direct labour costs are excluded from the genuinely variable costs used in throughput accounting calculations —pointed out the Hr and continued...

— I confirmed it with Em, but it is strange. Not only is there a fixed-basis salary system, but there are also some kinds of salary pay systems. Some are paid depending on working days, like our company.

—The Hr tried to summarize: —In short, the individual companies decide the categorization of variable costs based on employment status. For instance, Toyota. The wage payment to Gemba workers in factories in Japan is "Daily bases monthly salary system. Therefore, I think it is wrong to categorize direct labour costs to be operating expenses and except variable costs.

—Once again —the PM mentioned—, the formula of Throughput management.

$$\text{Throughput} = \text{Sales amount} - (\text{Materials} + \text{Outsourcing})$$

**2<sup>nd</sup> Jishu-Ken for Break-Even Point Analysis. Teaching Company.**  
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—This formula shows that Throughput accounting is focused purely on the Money coming in and Money going out. It aims to maximize a business's bottom line by focusing on money coming in (sales) and money going out. It looks at a business through a straightforward structure.

—Once again —the Hr wrapped up—, it is necessary to understand that its item differs depending on the company's salary payment system. For instance, our company. Our company is applying a Daily monthly wages system and a Daily wage system for production

workers' salaries. And Depends on the workload planning, the working capacity can be adjusted. Such employment and salary payment systems are popular in general. In such cases, the direct labour cost should be categorized as variable. Perhaps Throughput accounting assumes a monthly or annual salary system, which is not applied to the labour capacity adjustment depending on the workload planning.

—The point of Pm. is probably correct —the Hr mentioned—. And a little more, let's look at the contents of variable costs changeable to sales and production. There are some points to note. I picked up the variable costs related to sales amount or production as much as possible.

—And these are our company's ideas —Hr summarized—. And... the classification of variable costs for calculating marginal profit differs slightly depending on the individual companies. It is different depending on the company.

—Direct labour cost: This is different depending on companies. A company thinks overtime is a variable cost, but the salary excluding overtime is fixed; as the Pm said, it is fixed. Also, the direct labour costs are variable if the salary is an hourly wage system like our company.

—In both Marginal Profits, the costs directly related to sales or production are typically considered variable. In the context of Marginal Profit calculation, variable costs include all costs that vary with the level of output or sales, such as labour, cost of supplies or raw materials, taxes, utilities, and selling expenses.

—According to another book I have read —the Pm mentioned—, Variable costs of Throughput accounting is explained as follows: "*In the context of the Theory of Constraints (TOC) and Throughput calculation, Truly Variable Costs (TVC) are costs that var*

*y directly with the volume of units produced. They typically include costs like raw materials, direct labour, and specific" consumables.*

—There is some confusion. —the Sm questioned.

—It is indeed confused —the Mp agreed—. There are both direct labour costs included and not, aren't there? ...Thus, direct labour cost is more considerable, and it is next to materials. On the other hand, the Marginal Profit is clear, and includes the item of direct labour costs. Humm...? So, how can we judge it?

—Doesn't matter —the Em admitted—. Let's remember why we are comparing Marginal Profit Management and Throughput Management. The main theme is why our top management pursued the Marginal Profit Management, as the central pillar. And we don't intend to implement such a vague TOC and Throughput Management theory. Our management team pursues sound financial content, including recovering cash flow and "entire optimization" through pursuing Marginal Profit Management.

—Yes —Hr agreed—, it is. But it is too much to say that TOC is vague. TOC has a certain theory of "entire optimization." Throughput accounting has the problem of uncertainty in the dealing of direct labour. But, I believe pursuing "entire optimization" is essential for a company.

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The Pm intervened: —In the first place, let me make it crystal clear what is "entire optimization". My understanding is. The concept of "total optimization" is extremely important in our manufacturing industry as well...

—In the manufacturing industry, overall optimization is required to maximize the efficiency of the entire production line. Even if each department or process is optimized individually, it may not lead to overall optimization. Even if some production lines are made more efficient, overall productivity will not improve unless other departments are made more efficient.

—For example, we have focused on efficient production and sales of our main products, but this has not necessarily contributed to profits. Rather, we are trying to efficiently produce and sell high-mix, low-volume products with high marginal profits.

—Isn't this a case of overall optimization? —Pm asked everyone.

—I agree with you —Hr admitted—. By pursuing entire optimization, it is possible to reduce Muda in the entire manufacturing process and improve production efficiency. Mr. Accounting Manager said in a firm tone, "Don't buy, don't make, and don't stock useless things." Additionally, we must aim to strengthen collaboration between departments and maximize entire productivity. Currently, due to the pursuit of whole optimization, there is a possibility of conflict between departments. For entire optimization, high-mix, small-lot production is required, but on the other hand, production sites persist to mass-produced main products, even though inventory is piling up.

—It is a good way to earn and maximize marginal profit as a whole —the Hr concluded.

—So —Em pointed out—, once again, the items of variable costs. I corrected the items in the table of variable costs on my laptop next.

Variable cost of Marginal profit and TVC of Throughput		
Items	Marginal profit	Throughput
Raw material	Yes	Yes
Outsourcing	Yes	Yes
Direct labor	Yes & No	Yes? No?
Purchase parts	Yes	Yes
Electricity, Gas, Water, Air, Lubricant	Yes	No?
Machine spare parts & Maintenance supplies	Yes	No?
Safety protective equipment	Yes	No?
Packaging materials	Yes	Yes
Transportation	Yes	Yes
Sales commission	Yes	No?
Others related directly to sales and production	Yes	No?

—Then, the item categorization depends on the company. Our company applies the above categorization in the column Marginal Profit. May I have your agreement? —the Em asked himself, and without waiting for any answer, he continued—. We shouldn't forget another good point of Throughput management and accounting. It is very simple and understandable: Profit/Loss. The factors are Sales, Variable costs and Operating Expenses. It is a straightforward construction.

—If you say so, a Break-Even-Point Analysis we studied last time is also very simple to understand the P/L and Marginal Profit, isn't it? —questioned the Sm.

The Em explained it deeply: —So, there are no significant differences between our Marginal Profit Management and Throughput management of TOC. Both intend to optimize the entire process by viewing it, finding bottlenecks or weak points, and improving them. The TOC believers may probably have different or additional opinions. But it does not make sense to consider them even more.

—There is a big difference in the treatment of Direct labour costs. Our Marginal Profit Management involves it, but Throughput Management does not. We aim to achieve sound financial content by pursuing entire optimization with Marginal Profit Management. Sensei Kimura questioned us about what we wanted to do —and Em described my words—: And our answer was as follows —The Em continued:

### 3<sup>rd</sup> Jishu-Ken. Continuing the study in BEP analysis.

—When we explained our BEP analysis and tables in the monthly management team meeting, Mr. PD paled. I thought, why you noticed now do. It is, indeed, a bad financial result caused by bad inventory turnover and poor product quality. Our BEP analysis and the tables were indeed very sensational. Then, our suggestion was accepted by all. Anyway, the product M will be in bargain sale condition. The policy of "Prohibition of receiving the order in red"? —the Em asked himself then—, Do you really think that could be continued? This policy was initially stupid. And at last, it was abolished.

—The theme of this **Jishu-Ken** study is How to manage the "Entire Optimization for Sound Financial Content". Last time, we decided to organize it by BEP management. And we shall study it today.

—So —the Hr tried to understand—, how we should manage our Entire Optimization. I believe one of the key activities is BEP analysis. Actually, I had a dialogue with the Accounting department about the index, which should be easier for us. I propose that Mr. Accounting Manager lecture us about the entire optimization management by BEP management. And in this place, Sensei Kimura was there and joined with our dialogue.

—He said that he is also not an expert in the accounting system, but he needs to understand the company's situation from the point of view of accounting. Then, he also recommended that we use the BEP Management and said that there is no simpler and clearer method than it. He said that the variable numbers are only 3: sales amount, variable costs, and fixed costs. Then we can understand many significant accounting numbers...

—In there, I heard fascinating stories from Mr. Accounting Manager and Kimura-san. I will introduce it as follows: —said the Hr with a cup of coffee.

...And the Accounting Manager told me an interesting story. The following is the summary of the talking. The Accounting Manager starts:

*—By the way, Mr. Hr., recently, we have heard the word "Data-Driven Management, haven't we? Data-Driven Management. It is essential for managing a company.*

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*However. However, Mr. Hr., is data accurate enough to be used for the management team?*

*And he continued: —I never say that we are adverse to use for management, or a data inaccurate and insufficient to use it. But I ask you to have a sense of doubt about the figures. Data by number has an impact. —And, he asked the group: —For example, “unemployment rating increased by 5 points” and “the number of crimes committed by foreigners increased by 100,000”. Hearing that would make anyone feel uneasy. However, is it okay to accept that number without questioning it? "The numbers change depending on the definition of unemployment and crime, and even how they are counted."*

*—K.K; For example, I spent a long time in the UK, and I remember something that bothered me: The definition of unemployment in the UK has changed more than 30 times. The government has changed this in order to promote its unemployment measures and to suppress the payment of unemployment benefits. When xenophobic people count the number of crimes committed by foreigners, they tend to count delicate cases as crimes. After all, “In the end, it's people who make the numbers. Counting them properly is difficult, and there are too many cases to mention where policies were misguided due to inaccurate statistics.”*

*—For instance, our P/L Statement —the Hr asked—. Is it possible to believe our accounting system?*

*—No, No, No! —I rectify them—. Don't doubt the numbers. The numbers are correct. However, although the numbers are correct, the statement does not indicate profitability or deficit.*

*And I continued: —Your group are studying the difference between the Throughput and Costing systems. It is good. We are using the current accounting system and will use it in the future, as well. However, it is necessary to understand that this system has a lack. Yes, it is very clear defect.*

*—In the current accounting system, will profits increase as production in inventory increases? Why? —and I repeated—, Why did profit increase, even though we aren't selling it? —I asked them.*

*Then, the Hr answered: —Yes, we were having this doubt. Is our plant deficit, isn't it? However, the P/L Statement shows profitability.*

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*The Accounting Manager answered quickly: —In accounting, the reason why profits increase when inventory increases is related to calculating the cost of goods sold. Specifically, the cost of goods sold is calculated as "Purchased cost - Ending inventory." In other words, as ending inventory increases, cost of goods sold decreases, which increases gross profit (sales - cost of goods sold) —and he continued...*

*—For example: Beginning inventory; 100,000 USD. Purchasing cost: 400,000 USD. Ending inventory: 50,000 USD. The cost of sales will be 100,000 USD + 400,000 USD - 50,000 = 450,000 USD. If the ending inventory increases to 200,000 USD, the cost of products sold will be*

$100,000 \text{ USD} + 400,000 \text{ USD} - 200,000 \text{ yen} = 300,000 \text{ USD}$ . Since expenses have decreased by 150,000 USD, profits will have increased by that amount.

—However, this phenomenon is only an accounting issue; in actual business operations, increasing inventory does not necessarily lead to increased profits. When inventory increases, storage costs and inventory risks (product deterioration, going out of style, etc.) increase, which can worsen cash flow. In addition, although unsold inventory is recorded as an asset, it cannot necessarily be converted into cash, so it may result in a substantial loss.

—Hr-san, I believe you can understand this mechanism (dodge). Therefore, we are very keen to manage the inventory turnover index. Please understand that if this index worsens, it is necessary to doubt the result of the P/L Statement, even though it shows profitability. Numbers can be different according to the setting conditions.

**Throughput accounting:** Calculating profits using Throughput accounting is different from a general accounting system based solely on cost accounting.

In Throughput accounting, revenue is based on sales rather than production. In addition, since inventory is included in "variable costs," the more inventory there is, the greater the amount deducted from sales and the lower the throughput. In this way, Throughput accounting has emerged as something useful in actual management and is being utilized to increase profits. Specific ways to increase profits include increasing throughput, reducing inventory, and reducing operating costs.

The Hr agreed and questioned: —So, Throughput accounting is better than our traditional accounting methods, right?

—Yes —the Accounting Manager admitted—. In a manufacturing industry such as our company, it is better to use it to see the P/L situation. One time, Mr. PD lectured TPS and Just In Time to you. Throughput accounting and TPS are the same, meaning that "Inventory is evil." However, changing from general P/L Statement calculation to Throughput calculation will be tough because our mother company will never change and will be challenging to negotiate. Therefore, we decided to use the Direct Costing system and the General Accounting method in parallel in one definite condition (inventory turnover control).

---- (omit) ---

### Going back to the *Jishu-Ken*

—It is very much interesting information —admitted the Mp—. Even with that, I'm very much surprised by this, the general P/L Statement which we are using shows fake income. The accounting system where making more inventory yields more profit even when it's uncertain whether it will sell seems flawed, doesn't it?

—No, no! It is not flawed —the Hr pointed out—. According to Mr. AD, there are 2 "profit" calculation types.

—One is "Accounting Profit". Another is "Economic Profit" —described the Hr— Accounting profit (our P/L Statement) refers to the profit a company reports in its accounting. And, Economic profit refers to the actual economic profit earned by a company.

—When looking at the full year, this Accounting profit is correct numbers by plus and minus to be canceled out. However, in this era, we need to look at the result at least monthly, don't we?  
...We don't want to manage our company by so long term data. We should have a daily or at least monthly management cycle.

—Also, P/L Statement of general accounting method is inconvenient to manage factory. Therefore, the top management decided to use Direct costing P/L Statement. Of course, it is necessary to issue the monthly P/L Statement of general accounting method in parallel.

—The Sm hesitated: —Hmmm... Still I don't understand the Accounting profit and "plus & minus to be canceled out".

—I also questioned to Mr.AD about this point —said Hr— And, the following is his lecture:

*For example, if inventory increases at the beginning of a period, cost of goods sold will decrease by that amount, and profits will increase. However, if the inventory is not sold by the end of the period, it is recorded as ending inventory and affects cost of goods sold in the next period.*

*Purchased cost – Ending inventory*

*As a result, profits in the next period will decrease.*

*Therefore, even if inventory increases, it may lead to a temporary increase in profits, but the effect will be offset over the full year and the profit and loss numbers will be the same.*

—OK —admitted the Sm—, I understood. And anyway we need to seek sound monthly management. Therefore, we use both general P/L Statement and Direct costing monthly bases, even thou the numbers of P/L fluctuated in general P/L Statement.

### Direct costing

—General accounting method and direct costing method... —the Sm expressed his concerns—.

Hmmm... Understandable?!, for me it is not understandable.  
Everyone, do you understand these, don't you?

—Ha, ha, ha, ha! —The Em laughed—. Of course, we do. But I think it is necessary to review these in short and easy. Thank you very much Af-san for your attendance to our Jishu-Ken.

—Thank you very much too for your invitation — answered the Af and he continued the explanation started by Hr—. Direct costing and general accounting method. You see these for example in monthly management meeting, you do. Then, once again let's review these easy...

—Last time, we used this break-even point management to determine target sales and target selling prices for individual products. This time, let's use this method to look at the profit and loss of the entire company or department...

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—In corporate accounting textbooks, break-even point management is introduced as a method used primarily to determine sales target numbers. In terms of method, it is Direct cost accounting.

The Pm intervened: —It is a method of determining sales amount target. On the other hand, our company decided to abandon the "Prohibition of receiving order in red". Then, Sales department had gained the allowance of discretion in sales Gemba.

—However, it is not the meaning of to do discount sales always. Sales amount target, chasing sales amount. This is a dope for my staffs. It is easy to achieve any sales target in fact. If a discount sales is allowed by abolition of the policy of "Prohibition of receiving order in red", it is easy to achieve the target by price down. However, we can never gain profitability.

The Hr then understood: —Now I could understand why our management team changed the policy and direction from pursuing sales amount to pursuing marginal profit. Mr. Pm —he asked—. Your word is the answer. Let's pursue marginal profit than sales amount.

—Once again—the Sm asked to be sore—, we use both in monthly management meeting. And do we need to use both?

The Hr answered his question: —We use direct costing for factory management. And it is very useful to see the performance of the factories. But one of defect is the inventory issue. If it is used for factory performance evaluation, the KPI (Key Performance Index) of Inventory turnover should be managed more sever. The current situation is never sound.

—Please understand that the P/L Statement in our direct costing form is not general, but was arranged by Sensei Kimura and Mr. AD. —clarified the Af and continued...

PT. Banten		
Budget	Planned	Actual
Salaries personnel & Rent (PTM & OTC - Standard Hours)	Actual: standard & actual productivity x Standard (2,000)	
Planned Labour Cost	Product (Hour x BPH x Standard Total Labour Time)	
Planned Material Cost	Planned/Past year result or Planned/Material Efficiency x Price	
Planned (Marginal Profit)	(Sales - (2 x B)) x Average Profit/Labor product - Variable cost	
Actual Labour cost	Actual working hours x Planned result cost + Actualised Efficiency (Rate x B)	
Actual Labour Cost	Actual x Rate	
Labor Cost (Standard Hours)	Actual Efficiency (Planned & Actual), Rate x Cost	
Labour Cost (Actual Hours, Actual & Plan unproductive hours)	Actual hours x Actual rate	
Planned Material Cost	Actual x Rate x Financial cost (Rate x B)	
Planned Material Cost	Actual x Rate x Financial cost (Rate x B)	
Loss on disposal of assets	the part of material cost, Actual material usage loss.	
Loss on disposal of assets (Actual x Planned & Actual B)		
Minimum Loss Margin Protection	100,000	
Break Even (Manufacture Total)	100,000	
Advertising Cost	Actual as (Break Even and Variable Cost)	
Advertising (Planned & Actual B)		
Actual Marginal Profit	100,000	
Sales Expenses	(The Real-Salesmargin (Actual result) Rate x B)	
Sales Expenses (Actual margin - Standard)	Actual-Sales margin (Actual sales - other indirect expenses (efficiency & Environment Depreciation))	
Gross Profit	100,000	
Operating Expenses	Actual-Sales margin (Actual sales - other indirect expenses (efficiency & Environment Depreciation))	
Interest and administrative expenses	Actual-Sales margin (Actual sales - other indirect expenses (efficiency & Environment Depreciation))	
Operating Profit	100,000	
Non-operating Income		
Non-operating expenses		
Ordinary Profit	100,000	
Extraordinary Income/loss		
Pas		
Net Profit	100,000	

—The arrangement points are comparison of direct costs (labour and material) and marginal profits budget and actual. This device is for profit control (comparison of budget and results). Also there is another point, which is the detail of fixed costs.

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—And it is possible to see the monthly P/L situation and the factories' performance —The Af finally concluded.

—Probably we could understand the mismatch of this P/L Statement and general accounting P/L Statement by the dispute of Messrs PD and AD in the last management meeting —asked the Hr—. The timing of production and their sales is completely different by the excessive inventories. This direct costing P/L Statement is very much useful. But it is necessary to control the sound inventory turnover to use it and for matching to the accounting P/L Statement.

—Today —the Af continued his clarification—, I prepared the example which is general direct costing form. Direct costing. It is indeed same to BEP system. In fact, many companies set their overall sales target based on the break-even point. But as you know, our company is different.

—According to Sensei Kimura —the Af continued—, even though they have taken the pains to set their sales target based on the break-even point, I see companies that manage their operations based on cost calculations that distribute fixed costs at the operational stage.

—There's something wrong with this. This is probably because it is written in accounting textbooks, but I think most companies hire staff without thinking about it. Is it really possible to carry out solid business management when the concepts of goal setting and execution management are different? When we think about it carefully, we tend to take things at face value just because they are written in textbooks.

—What??? —the Sm asked surprised—What is the wrong point?

—Simply —the Af answered— it is the problem of indirect cost distribution. Please look at next tables, which are general accounting P/L Statement and Direct costing P/L Statement.

—General accounting P/L Statement →:

Departmental P/L Statement (General)				19xx.Mar.
Department	Plant-1	Plant-2	Plant-3	Total
Sales amount	100	80	70	250
Manufacturing cost	60	50	30	140
Gross Profit	40	30	40	110
S & General A Expences	40	32	28	100
Operating Profit	0	-2	12	10

S & General; Selling & General Administrative Expenses.

—It is simplified from next form P&L →:

—Hmmm? —the Em hesitated—Is this an example of our company, isn't this? We have plant-1, plant-2, 2 and 3.

—Yes this is —Af confirmed—. Beginning of last year, our company was still profitable barely. I use the achievement for a month as the example. As you know, plant-2 which is producing main products was still minor deficit at that time. But now, plant-2 is the major cause of total company deficit.

—Yes —Pm confirmed—, the last one and half year was a turbulent year, it was. Fell in deficit. TPM project. Changed the way of TPM project. Changed outsourcing policy to in-house. Organization changed. Started Management team. Mr. MD took up. And Sensei Kimura re-arrived. Many things were changed.

P/L
Sales Amount
Manufacturing Cost
Gross Margin
Selling Expenses
General and Administrative Expenses
Operating Profit
Non-Operating Income
Non-Operating Expense
Ordinary Profit
Extraordinary income
Extraordinary loss
Tax
Net Profit

—And —Hr confirmed—, this falling into deficit was a trigger of very rapid change. By the way, before your lecture. Have you something announcement to us, haven't you? Of course, you have. Yes?

The Af hesitated for a while and just after a second he asked: —What are you talking about?

—No, no, no! —the Hr answered—. Af-san. Recently you are married, yes? Additionally, the bride is K-san who is former project leader. Right?

—What!? —Pm did not have any idea what they were talking about—. Did you marry with Miss K? Is it the meaning of you stole excellent team leader from our company.

—No, no! —the Af denied—. There's not the matter I could steal her. She is working other company. After Mr. Kimura leaving, the project has disappeared. Did she steal something? May be yes. She got many knowledge such project management & leadership, TPS concept, true TPM, relation of accounting and Gemba with through the project activity. However, she was fed up with this company after the project.

—I see —the Em admitted—. And. From when have you planned to steal her? Admittedly, you were supporting this project as a staff of accounting, weren't you. Actually, were supporting just her? No, no, no. It is joke. And are you happy now?

—Yes we are —the Af asserted—. Sensei Kimura attended our marriage by TV conference from UK. Now he is leaving her work for maternity leave. Everyone; Maternity!? Congratulation!

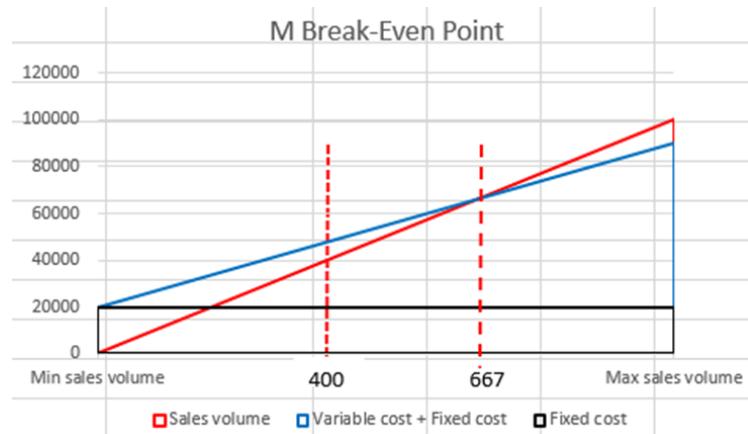
...I omit the idle talk...

—Let's go back to our main theme —the Em broke the idle dialogue—. So, please explain your materials prepared, Mr. Af.

—Ok —the Af admitted—. Please let's look at this situation by replacing to direct costing. We studied BEP analysis at the last study.

—Wait a minute Af-san —requested the Pm—. Our main theme is to understand the top policy of pursuing marginal profit and direct costing. Why do you re-explain BEP analysis?

—I know, please listen Mr. Pm —requested him Af—. As a matter of fact, BEP and direct costing are (almost) same. You remember next BEP analysis, you do. The following is the BEP analysis of one of our main products M. I believe you remember these tables well.



Numeric value-1-P/L		
Item	Formula	Value
Sales volume	G	500
Sales amount	H=GxA	50,000
Fixed cost	I=D	20,000
Variable cost	J=GxB	35,000
Variable cost + Fixed cost	K=I+J	55,000
Marginal profit	L=H-J	15,000
Profit & Loss	P/L=H-K	-5,000

—Yes we remember it. Particularly this BEP analysis of the product. The monthly management team meeting was rough.

The the Af continued: —Let's replace this table to the direct costing. Direct costing P/L Statement is as below:

Departmental P/L Statement (Direct Costing) 19xx. Mar				
Department	Plant-1	Plant-2	Plant-3	Total
Sales amount	100	80	70	250
Variable cost	60	50	30	140
Marginal Profit	40	30	40	110
Fixed cost				100
Operating Profit				10
Variable cost; Direct labor cost included				
Fixed cost; No allocated to each plant				

—Also, it is simplified from next standard form →:

—As you see, there is no allocation of fixed costs.  
And the fixed cost allocation is just in the column of Total —the Af continued...

—As a matter of fact, a Direct costing is seemed to be developed from BEP management.

—It is very simple, isn't it. Because any indirect costs is not allocated. Direct costs. Our company is taking the way of thinking that labour cost is involved in variable costs. Materials is of course variable costs.

Direct cost such labour and material costs are comparatively clear between each plants and there is no necessary to allocate these. But indirect costs. This indirect costs distribution is sometimes the causes of conflict between our plants. Because the profits are influenced by the indirect costs allocation.

—Yes it is —the Mp admitted—. I also have heard the complaint from plant managers. P/L. In fact, it is the assessment for each managers. Anyway they are very serious about it. At any rate, their assessments are evaluated based on such vague allocation.

—How the fixed costs allocation is decided? —then, the Hr asked.

IPS Statement	Remarks	Note
① Sales amount & Sales Kihon(Standard Hours)		Actual amount & sales products x Standard m/P
② Planned Labour Cost		Product Sold x HR x Standard Unit Labour Cost
③ Actual Labour Cost		Actual Labour hours x Planned Material (Standard) Cost
④ Planned Marginal Profit	$(1-1)(2-3)$	Marginal Profit/Sales amount Variable cost
⑤ Actual Labour cost		Actual working hours x Planned unit cost x Actual Efficiency
⑥ Labour Cost Modification	$(1-3)-2$	Same to ④
⑦ Labour Efficiency, Planned & Actual%, Repair-Cost		
⑧ Quality Defect Ratio, Actual & Plan of Production Kihon		
⑨ Actual Material Cost		Actual amount of material cost
⑩ Planned Material Cost		Same to ⑤
⑪ Loss on disposal of waste		The part of material costs Actual material scrap loss.
⑫ Loss rate, Planned & Actual %		
⑬ Material Cost Modification	$(1-8)-3$	
⑭ Direct Cost Modification Total	$(1-7)+(1-11)$	
⑮ Manufacturing Cost		Referred as Direct Cost and Variable Cost
⑯ Selling Expenses, Actual & Actual Kihon		
⑰ Actual Marginal Profit	$(1-6)-(1-13)$	
⑱ Direct Expenses		Other than Outourcing (Metal parts, Tools, etc.)
⑲ Factory (Manufacturing) Overhead		Indirect Material, Indirect Labour and other indirect expenses (Machine & Equipment Depreciation)
⑳ Gross Profit	$(1-14)-(1-15)+16$	Sales commission, sales promotion cost
㉑ Selling Expenses		Advertising cost
㉒ General and administrative expense		Personnel costs (Salaries, bonuses, various allowances) for indirect departments, costs for operating the office of indirect departments etc.
㉓ Operating Profit	$(1-17)-(1-18)+19$	
㉔ Non-Operating Income		
㉕ Non-Operating Expense		
㉖ Ordinary Profit	$(1-20)-(21-22)$	
㉗ Extraordinary Income or Loss		
㉘ Tax		
㉙ Net Profit	$(1-23)-(24-25)$	

—Now fixed cost is distributed based on the production KMH (kilo standard hours; production result x standard time/1000) —the Af explained.

—oh —surprised the Hr—, it is not the shipping result, but production results, even though it is mismatched to shipping result.

Em showed his concerns as well: —It may not be possible to manage a factory if it is not possible to analyze accurate cost details, maybe? ...Additionally, general accounting P/L Statement shows profitability, even if producing excessively and calculating as assets. Not selling but shows profitability. Something wrong, isn't it?

Therefore, we decided following 3 points —the Hr explained:

- 1<sup>st</sup> is it is to use both general accounting and direct costing.
- 2<sup>nd</sup> No fixed cost allocation.
- 3<sup>rd</sup>, target marginal profit rather than pursue sales amount and profit.

At this Jishu-Ken, we studied 2 things broadly divided —the Em pointed out—: One is, Why our company decided to pursue Marginal Profit than general accounting profit as main pillar. And the other one is the use of Direct costing P&L Statement...

—**Firstly**, it became clear why our company decided to pursue marginal profit first rather than general accounting profit...

—The answer is to eliminate the accounting distortion. In general accounting, it has the characteristic of encouraging production too, even excess production which are becoming warehouse fertilizer...

—Overproduction becomes inventory. An increase in inventory will increase book profits, but in actual management, excess inventory becomes a problem. Excess inventory may not be able to be converted into cash or may be delayed, putting pressure on cash flow...

—**Secondly**, the use of direct costing P/L Statement. We have been using this for a long while. However, now we haven't considered why we are using both general accounting P/L Statements and direct costing. Now we could understand its necessity to use both...

—Even direct costing P&L Statement, it has a distortion if the inventory turnover cannot be controlled properly.

—So, shall we close this Jishu-Ken and choose the next theme? —the Em finally asked everyone and he pointed out and questioned: —Marginal Profit pursuing and Direct costing. I think we need to continue these study more. Shall not we study how to manage the factory by these from next, shall we?

—I agree —the Pm asserted.

—I think it is a good theme. Let's study how to manage the factories by these —Em agreed, and he requested the help of the Af—. Thank you for your assistance. And please continue for a while. And please let us know your baby's birth.

It will be continued...

## IV. Next Lecture.

We continue the above TQM description and Teaching Company and Cost Reduction (to be continued)

Koichi Kimura, CC4 – August – 2024.

Factory Management Institute